**LAB 4**

**CONSTRUCT A SIMPLE NETWORK**

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ID: B2111933

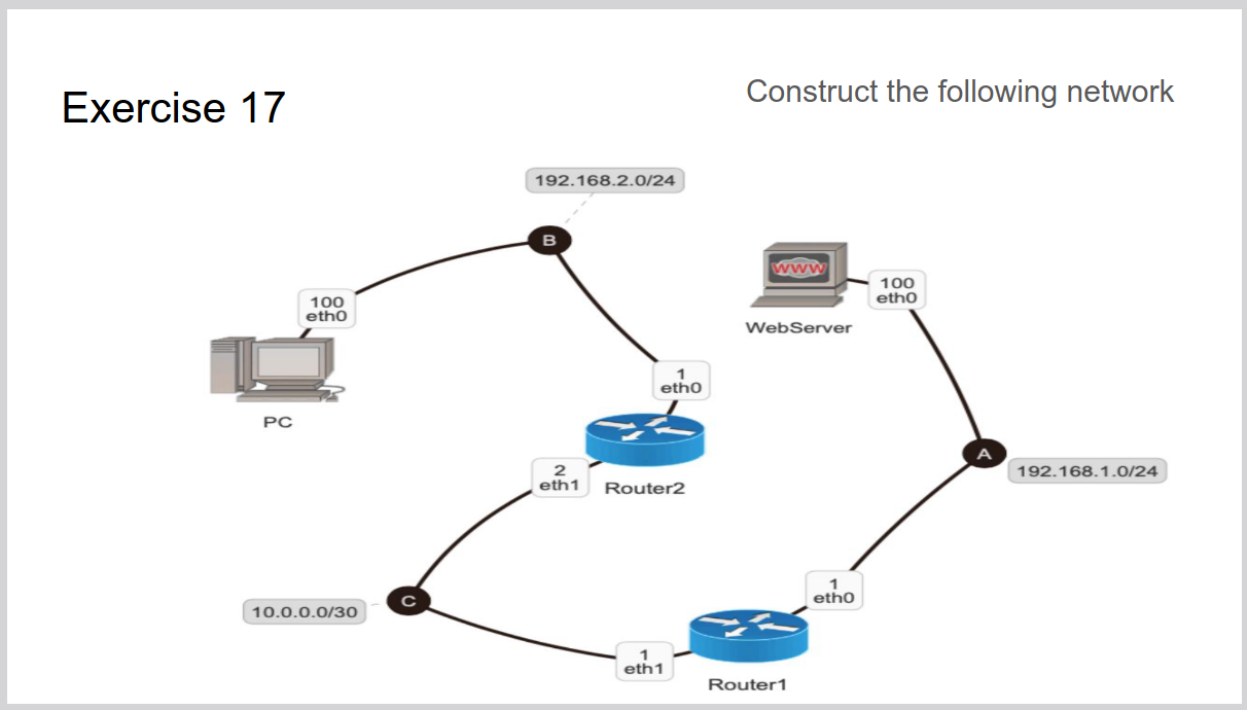
Group: M04

*Submission: an ID_NAME_Lab04.pdf file describes clearly how did you solve the problem*

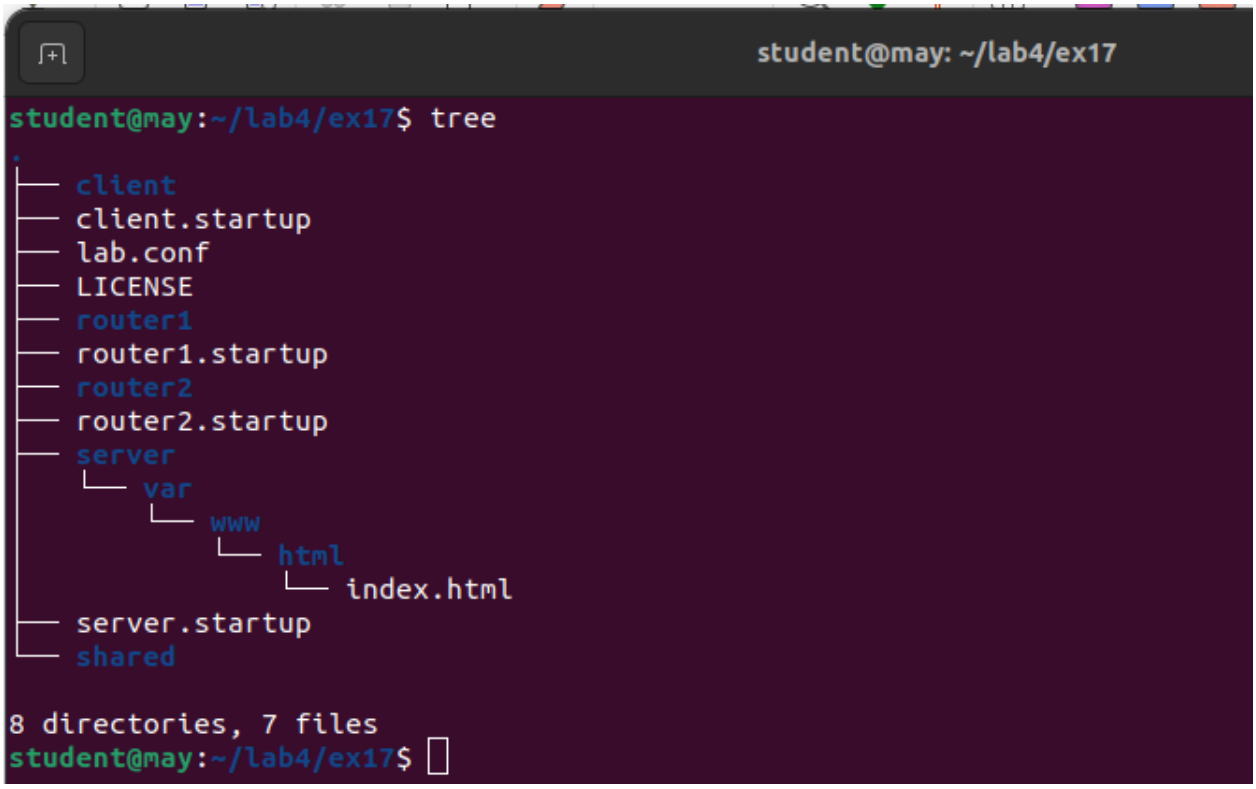
**Exercise 0:** change the directory to your home directory

Answer: $cd

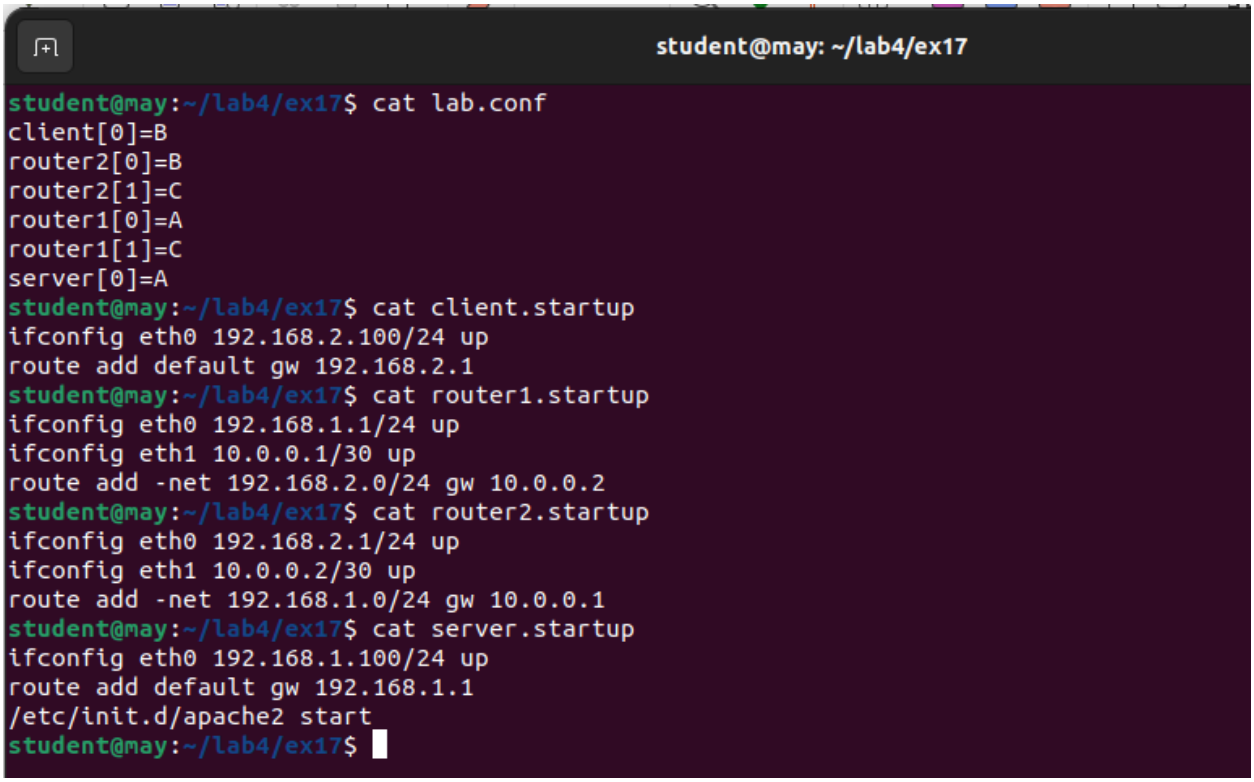

Exercise 17



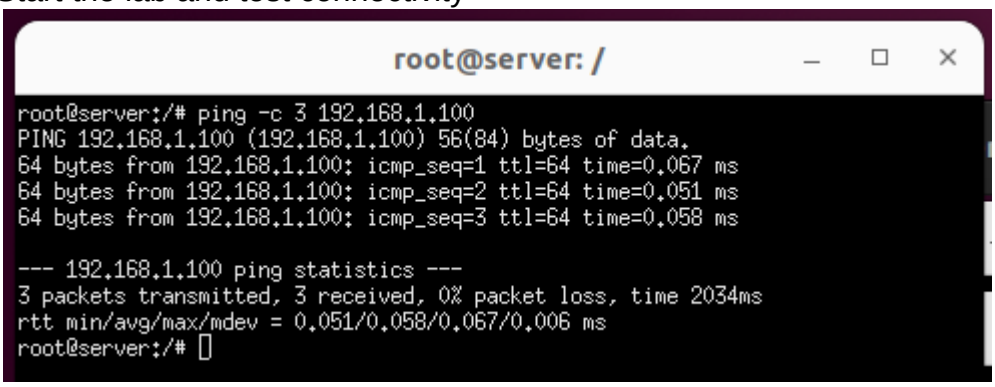

Create files and folders



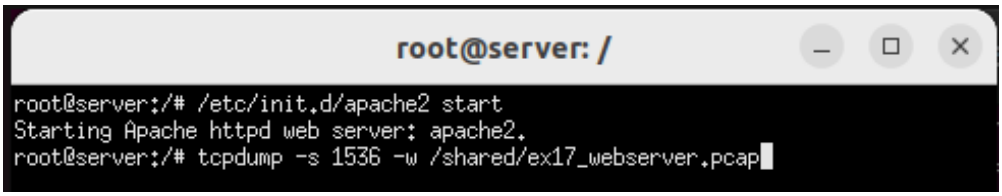
The contents of files:



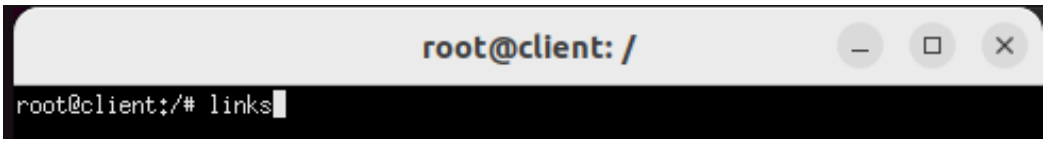

Start the lab and test connectivity



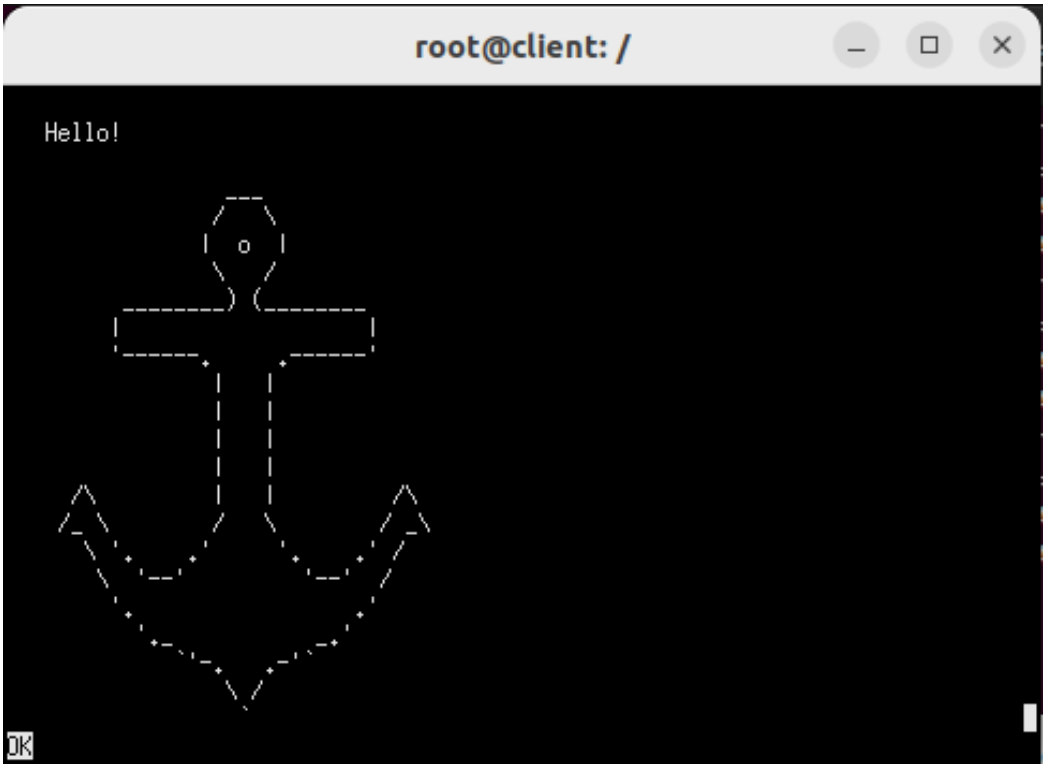

On server



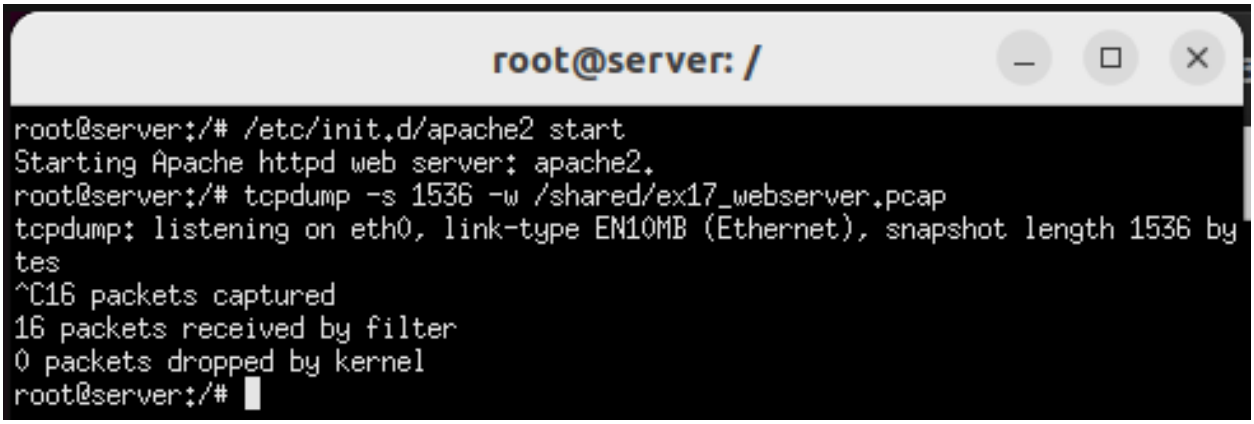
On client


root@client: /
root@client:/# links

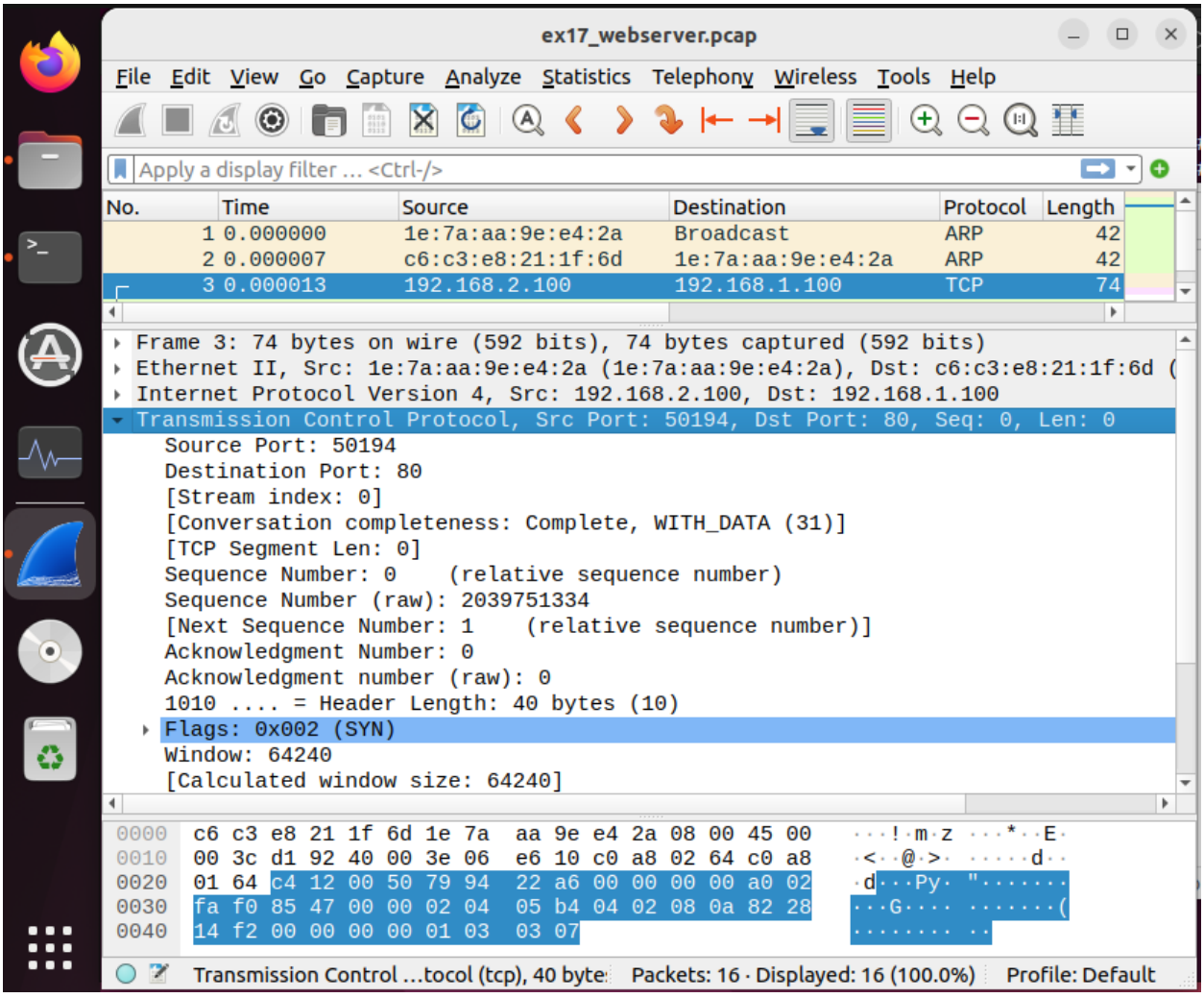

root@client: /
Go to URL
Enter URL
192.168.1.100
[ OK ] [ Cancel ]


root@client: /
Hello!
OK

Back to server

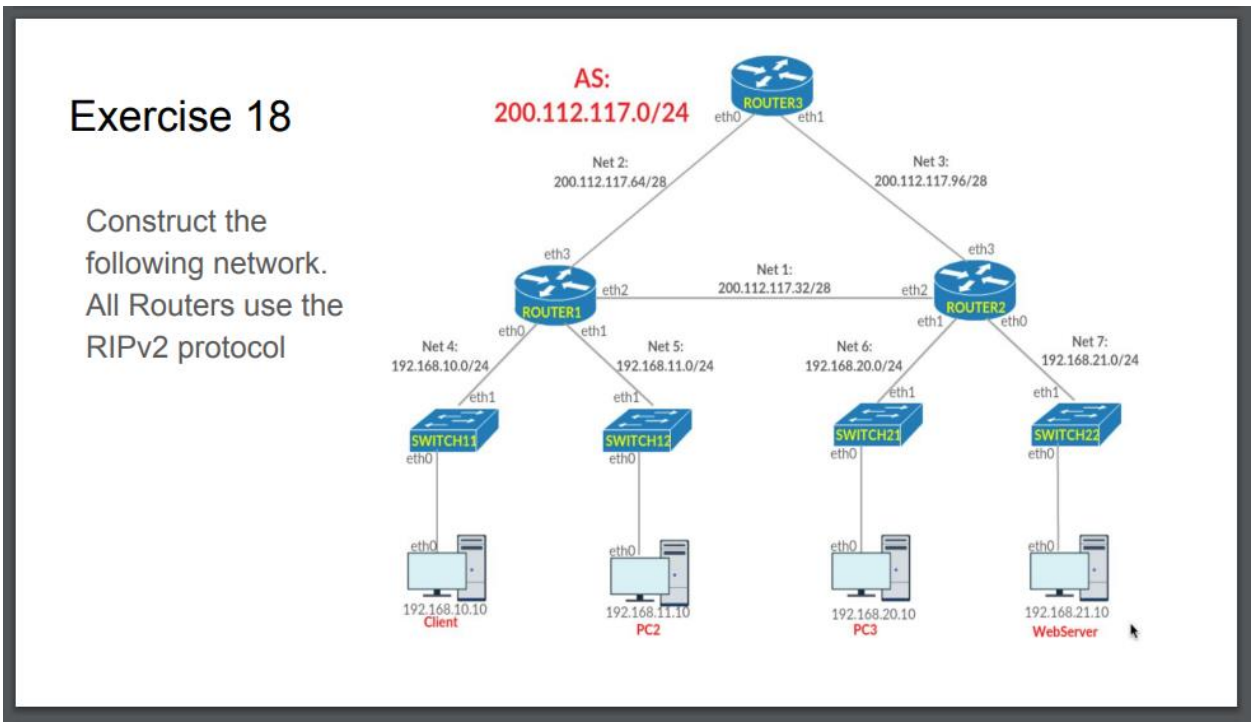



Open ex17_webserver.pcap to examine Frames and discover the TCP Header

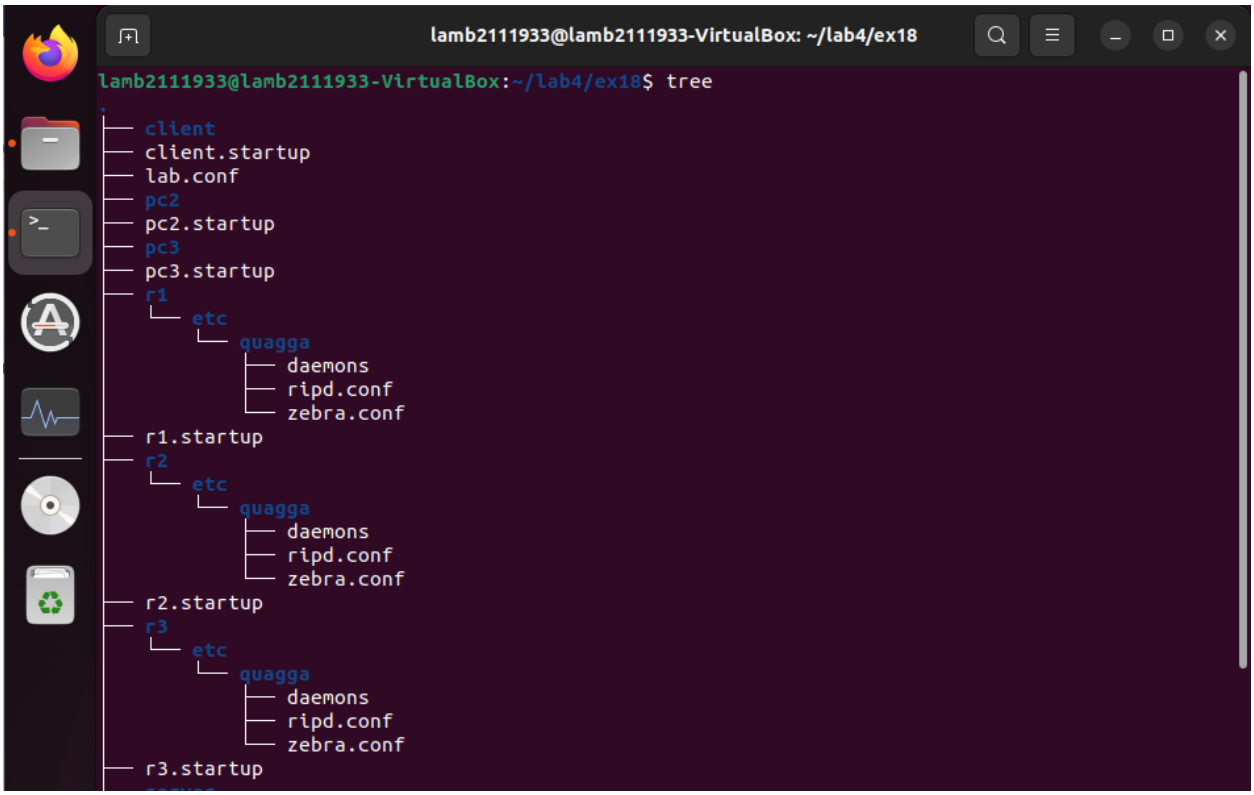


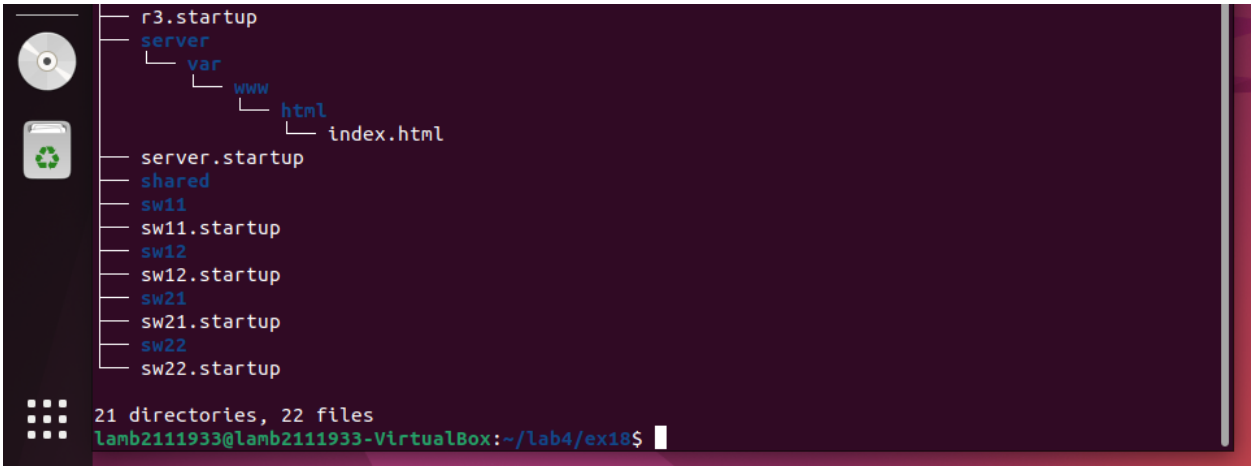

Frame 3 – Length 74 bytes - Source Port: 50194 - Destination Port: 80 (HTTP)

# Exercise 18

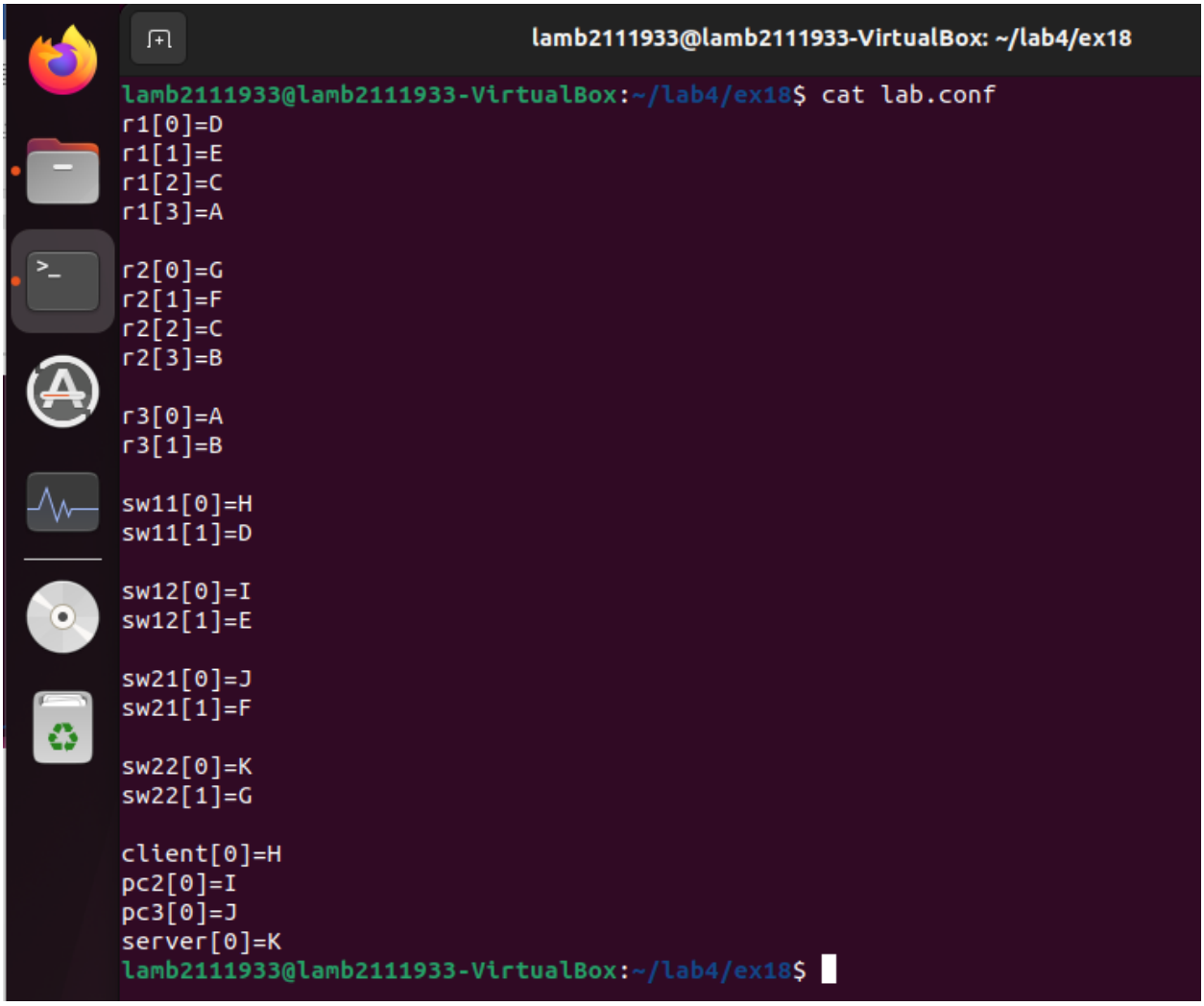


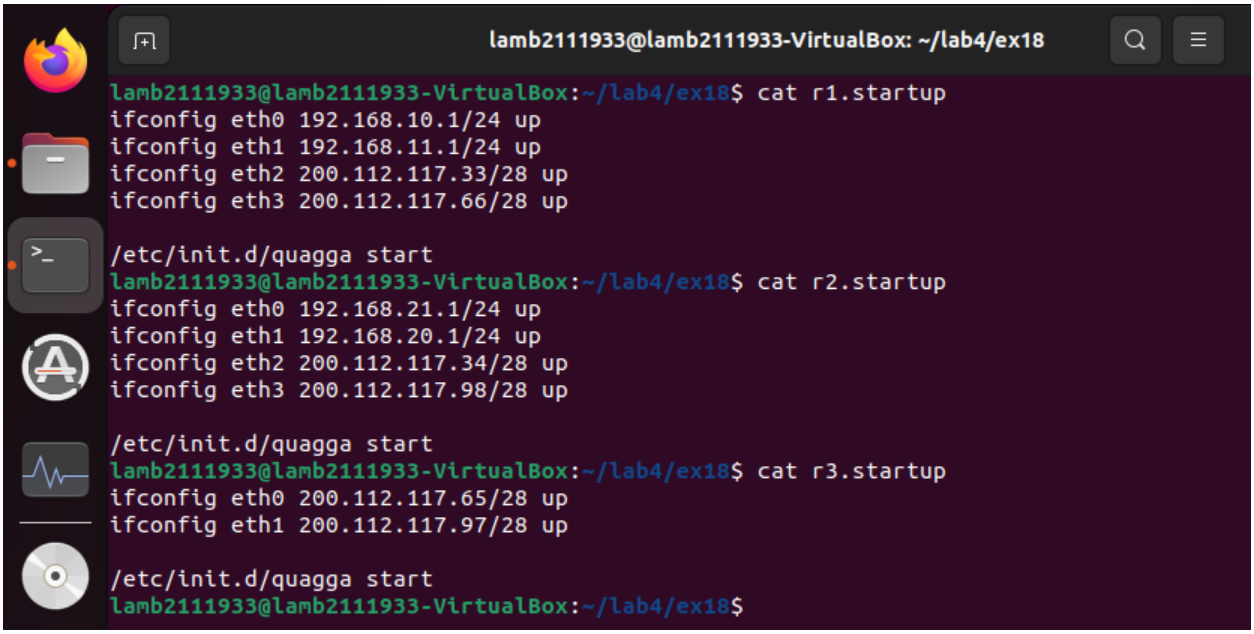

Create files and folders

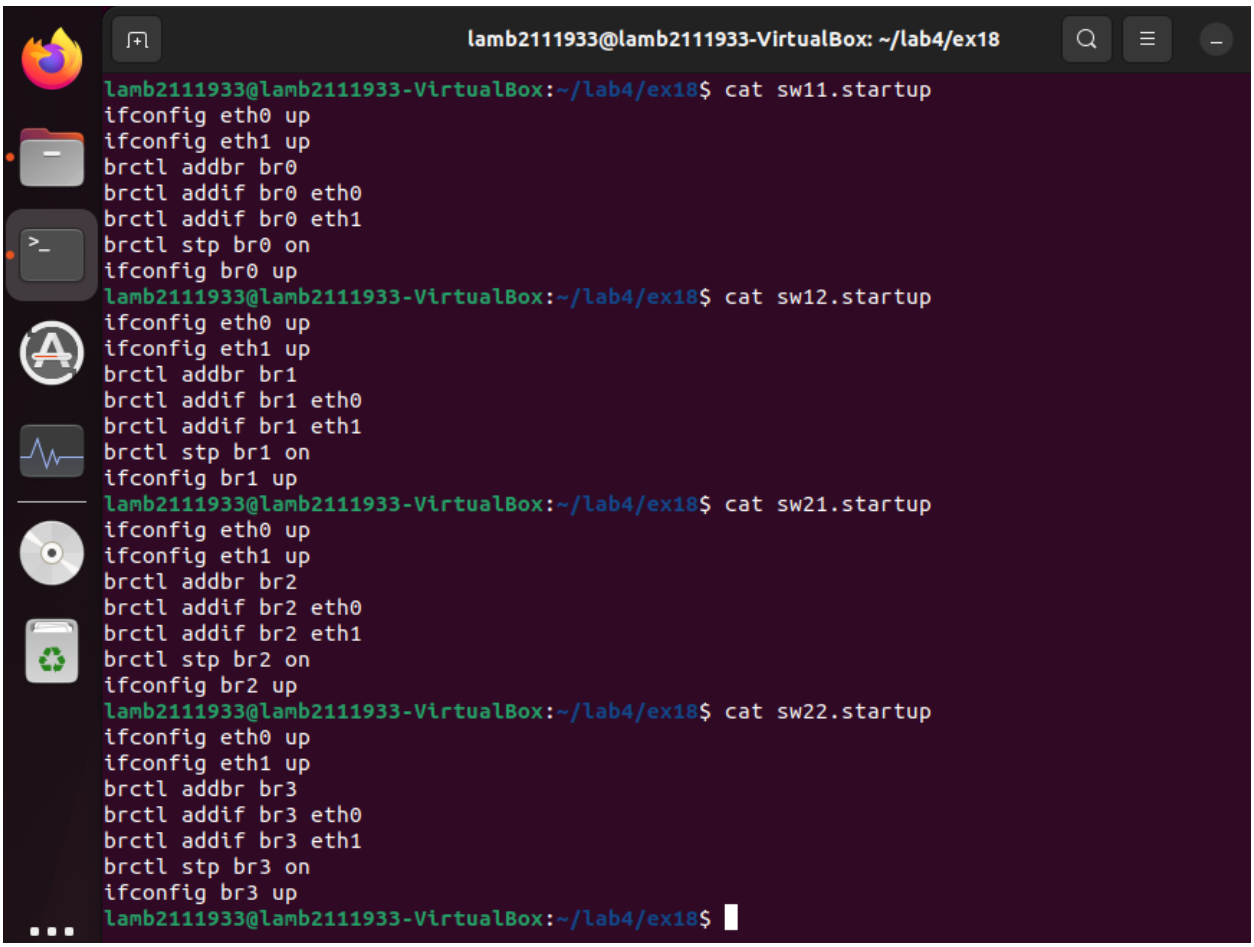


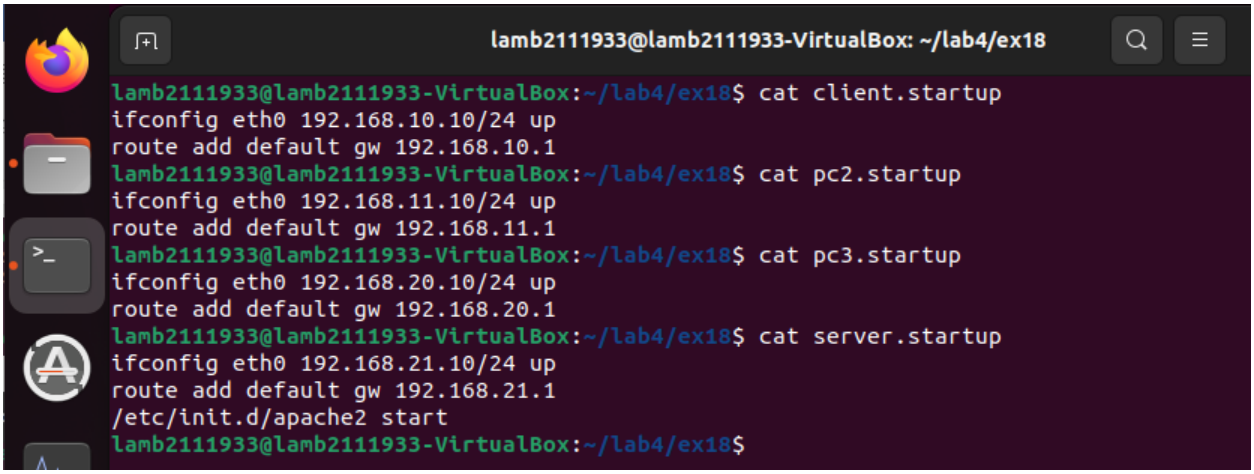


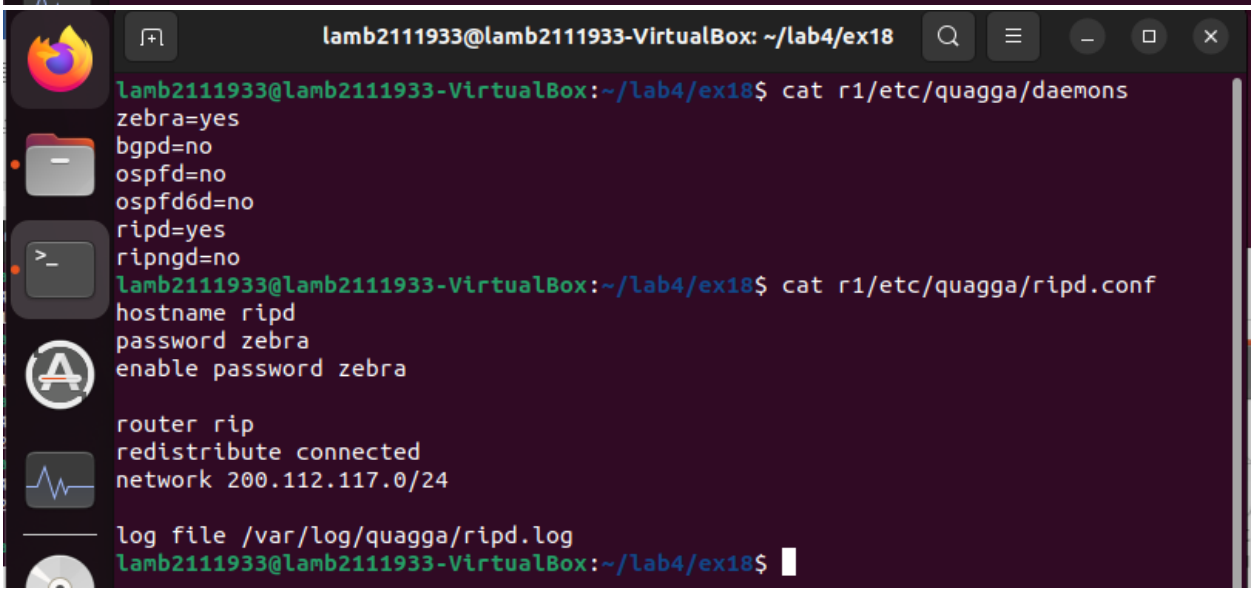

The contents of files

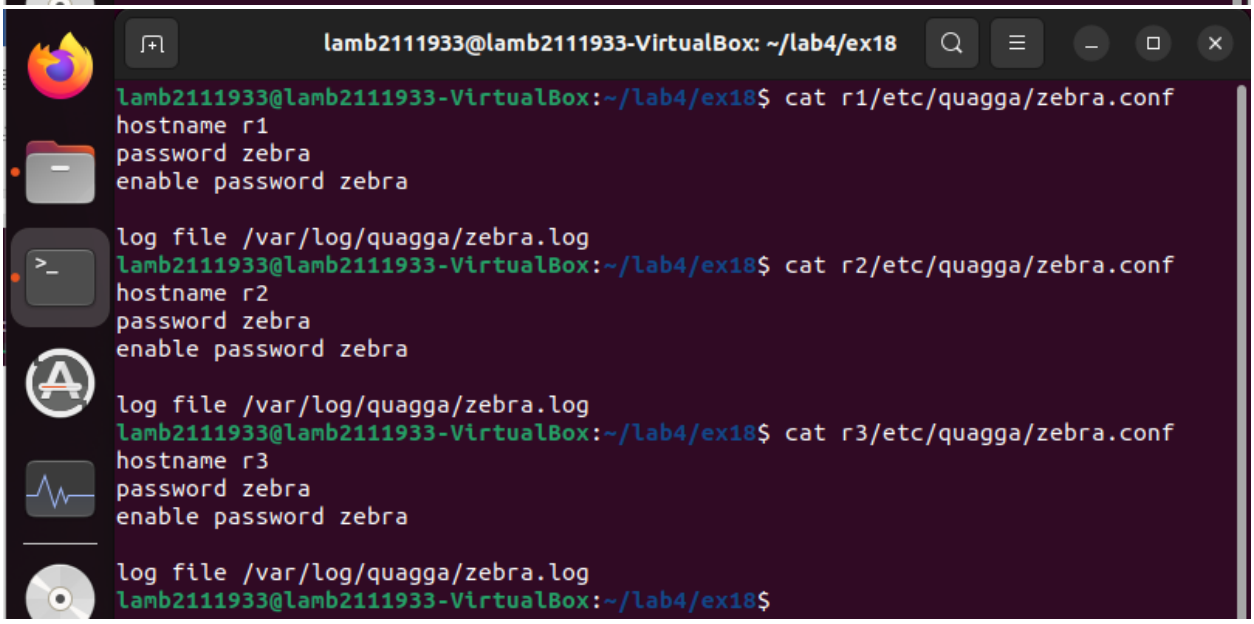



lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1.startup
ifconfig eth0 192.168.10.1/24 up
ifconfig eth1 192.168.11.1/24 up
ifconfig eth2 200.112.117.33/28 up
ifconfig eth3 200.112.117.66/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r2.startup
ifconfig eth0 192.168.21.1/24 up
ifconfig eth1 192.168.20.1/24 up
ifconfig eth2 200.112.117.34/28 up
ifconfig eth3 200.112.117.98/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r3.startup
ifconfig eth0 200.112.117.65/28 up
ifconfig eth1 200.112.117.97/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$

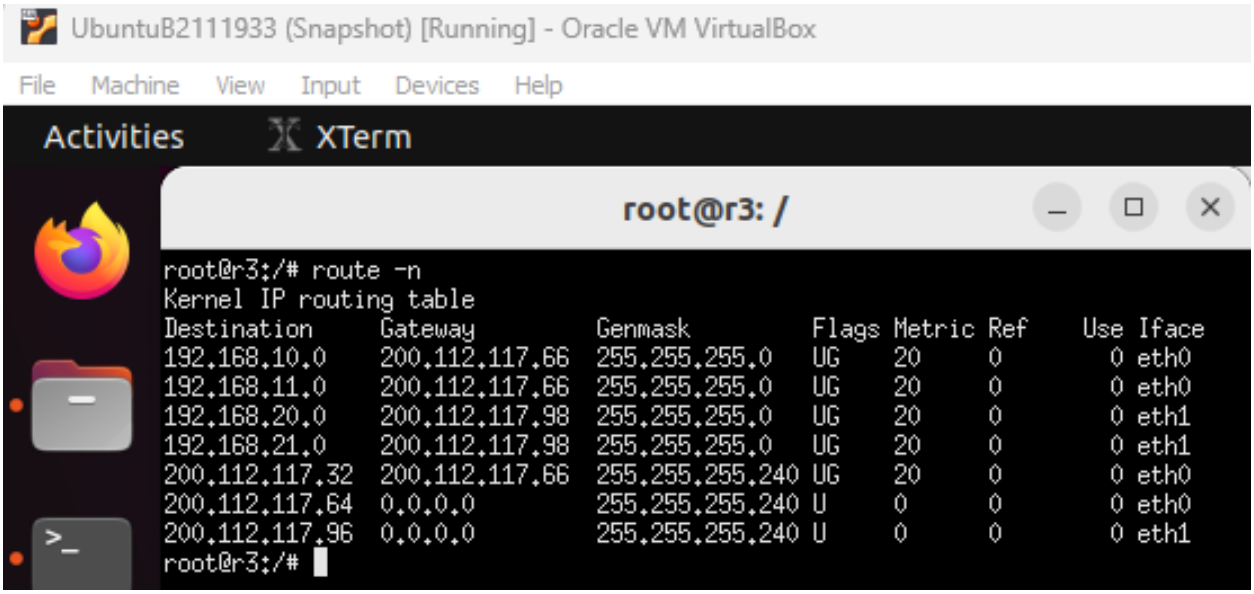

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw11.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw12.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl stp br1 on
ifconfig br1 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw21.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br2
brctl addif br2 eth0
brctl addif br2 eth1
brctl stp br2 on
ifconfig br2 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat sw22.startup
ifconfig eth0 up
ifconfig eth1 up
brctl addbr br3
brctl addif br3 eth0
brctl addif br3 eth1
brctl stp br3 on
ifconfig br3 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$


lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat client.startup
ifconfig eth0 192.168.10.10/24 up
route add default gw 192.168.10.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat pc2.startup
ifconfig eth0 192.168.11.10/24 up
route add default gw 192.168.11.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat pc3.startup
ifconfig eth0 192.168.20.10/24 up
route add default gw 192.168.20.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat server.startup
ifconfig eth0 192.168.21.10/24 up
route add default gw 192.168.21.1
/etc/init.d/apache2 start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$

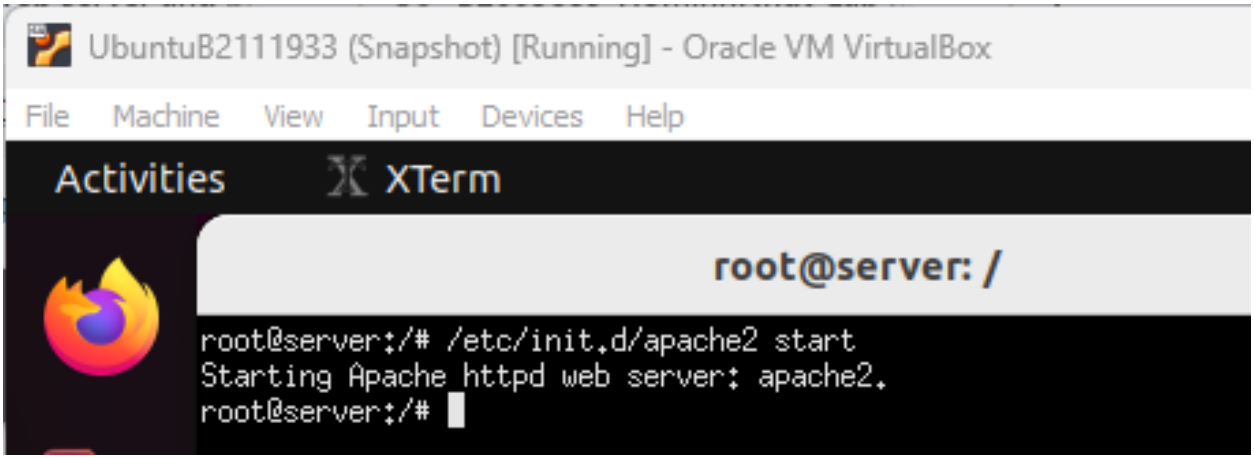

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra
router rip
redistribute connected
network 200.112.117.0/24
log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$


lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex18
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r1/etc/quagga/zebra.conf
hostname r1
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r2/etc/quagga/zebra.conf
hostname r2
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$ cat r3/etc/quagga/zebra.conf
hostname r3
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex18$

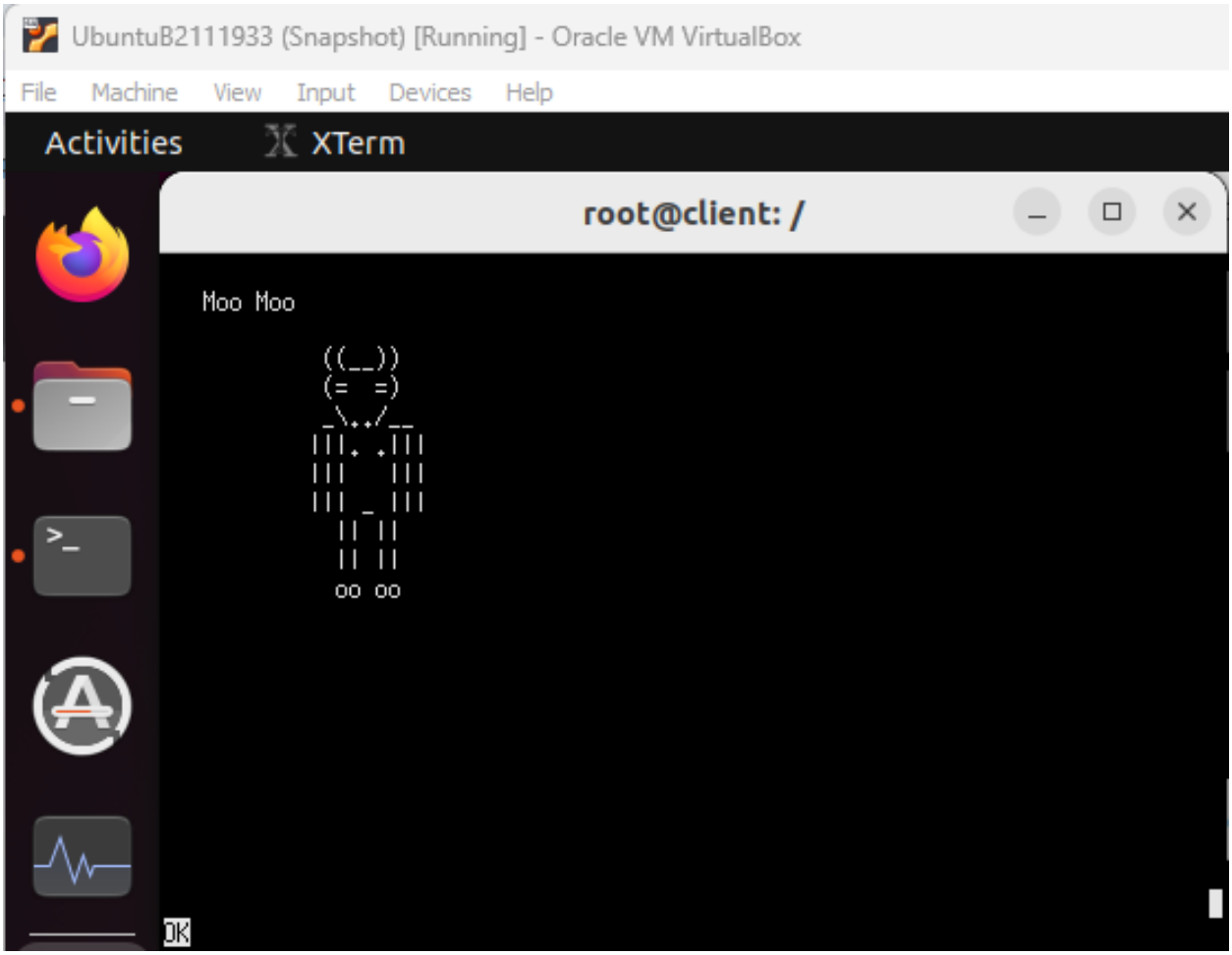

Start the lab and test connectivity



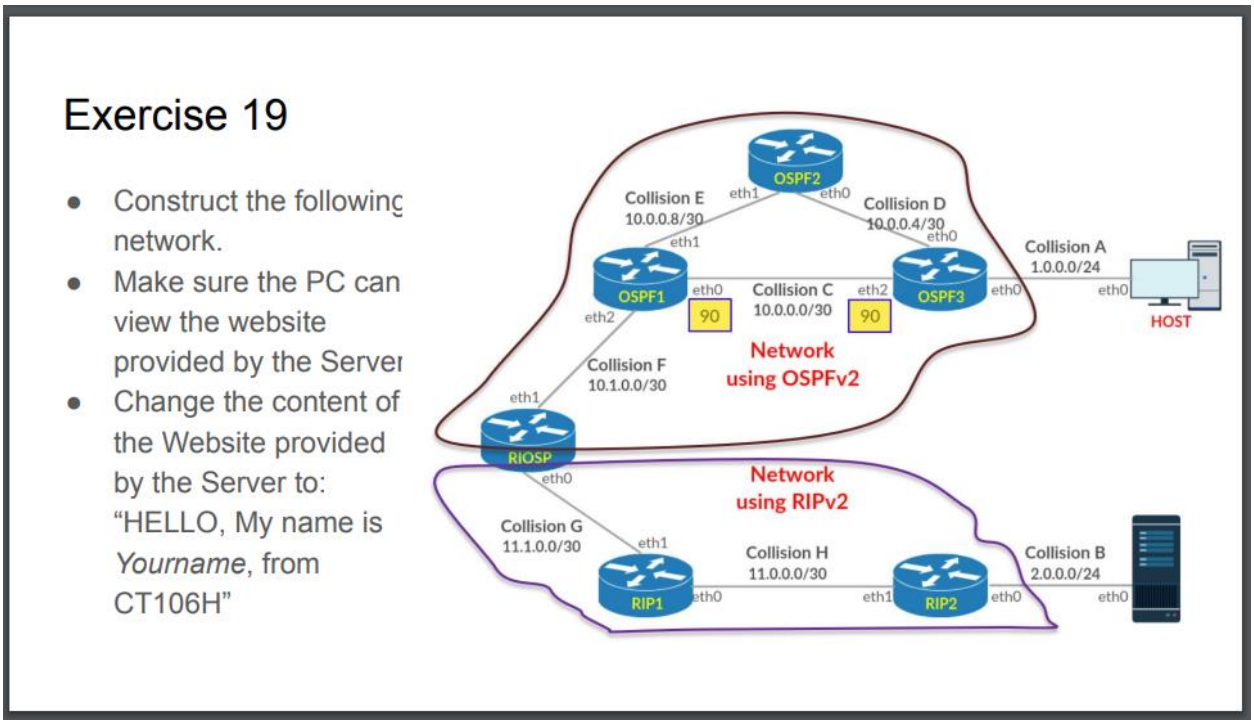
On server



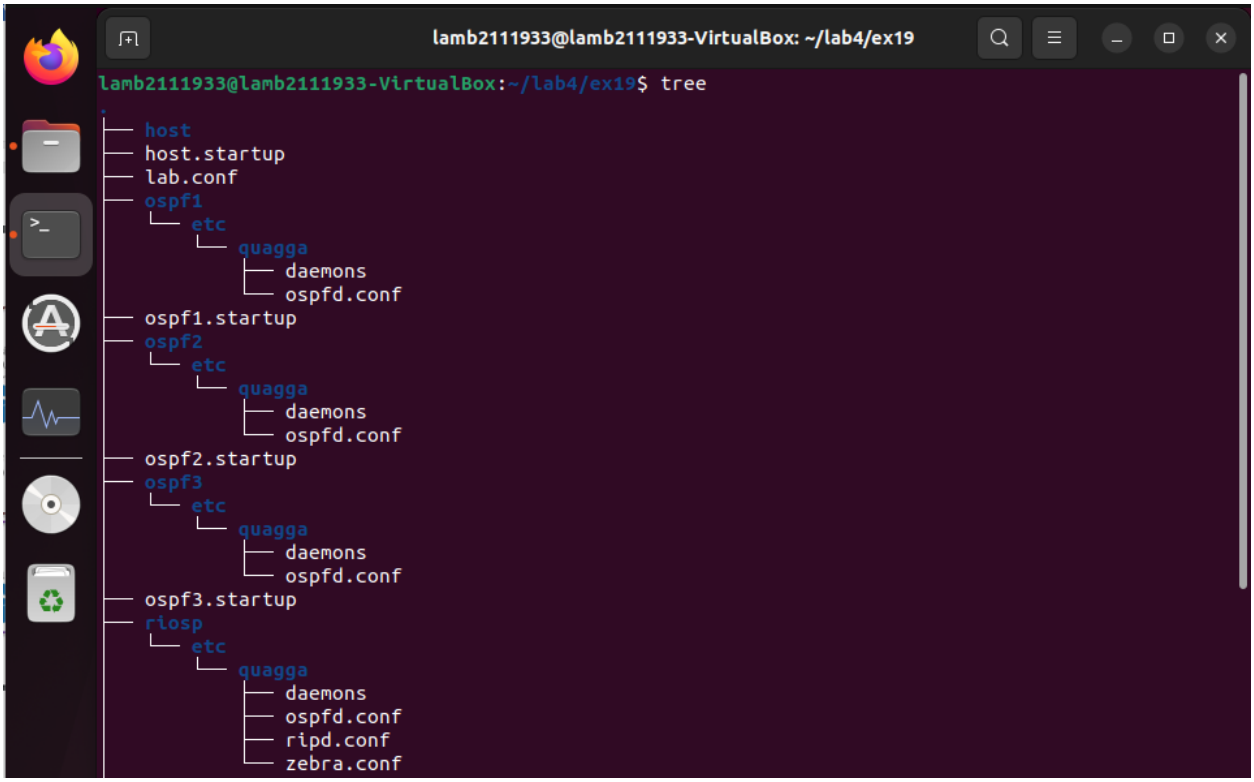

On client

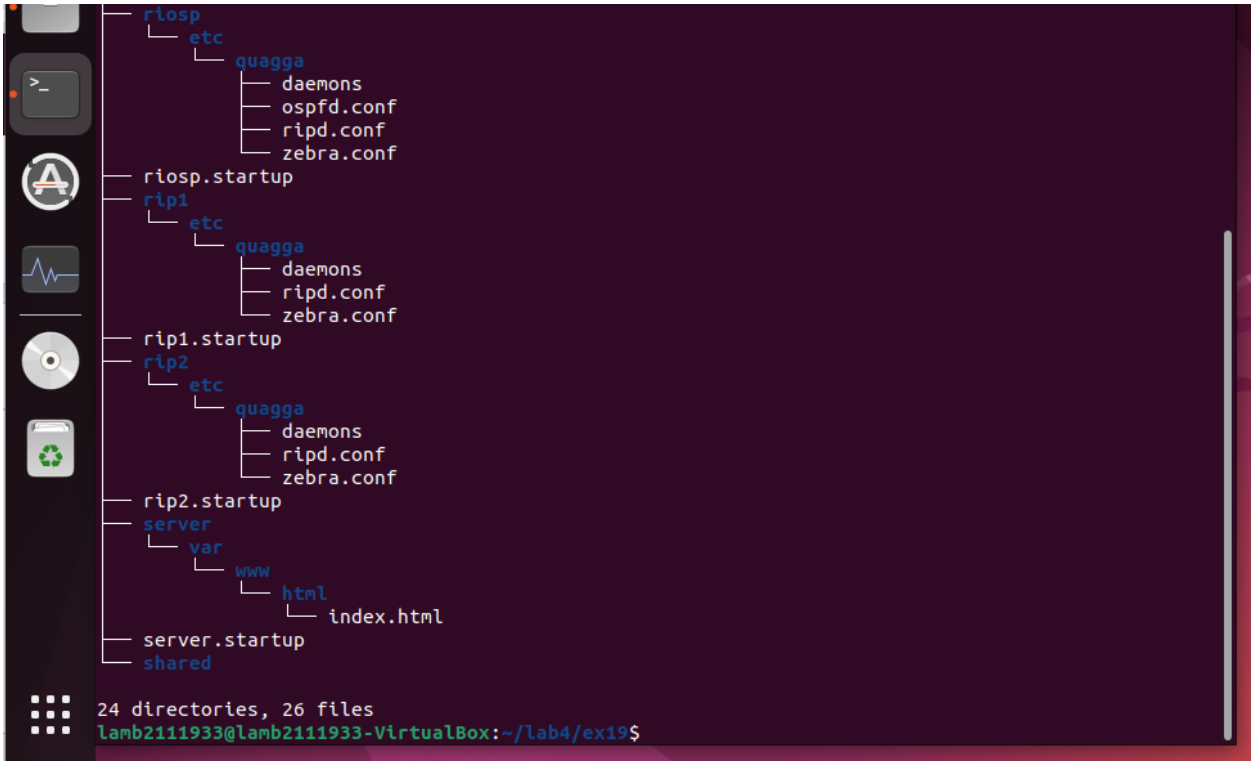


# Exercise 19

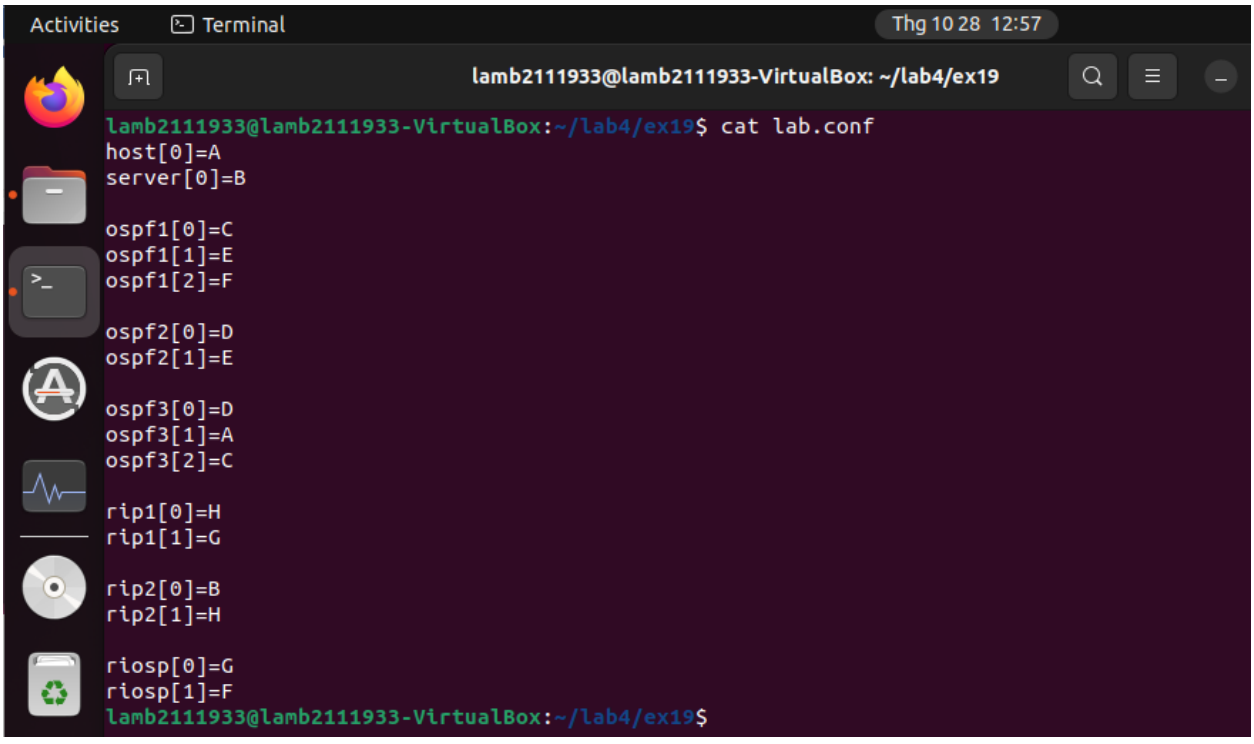


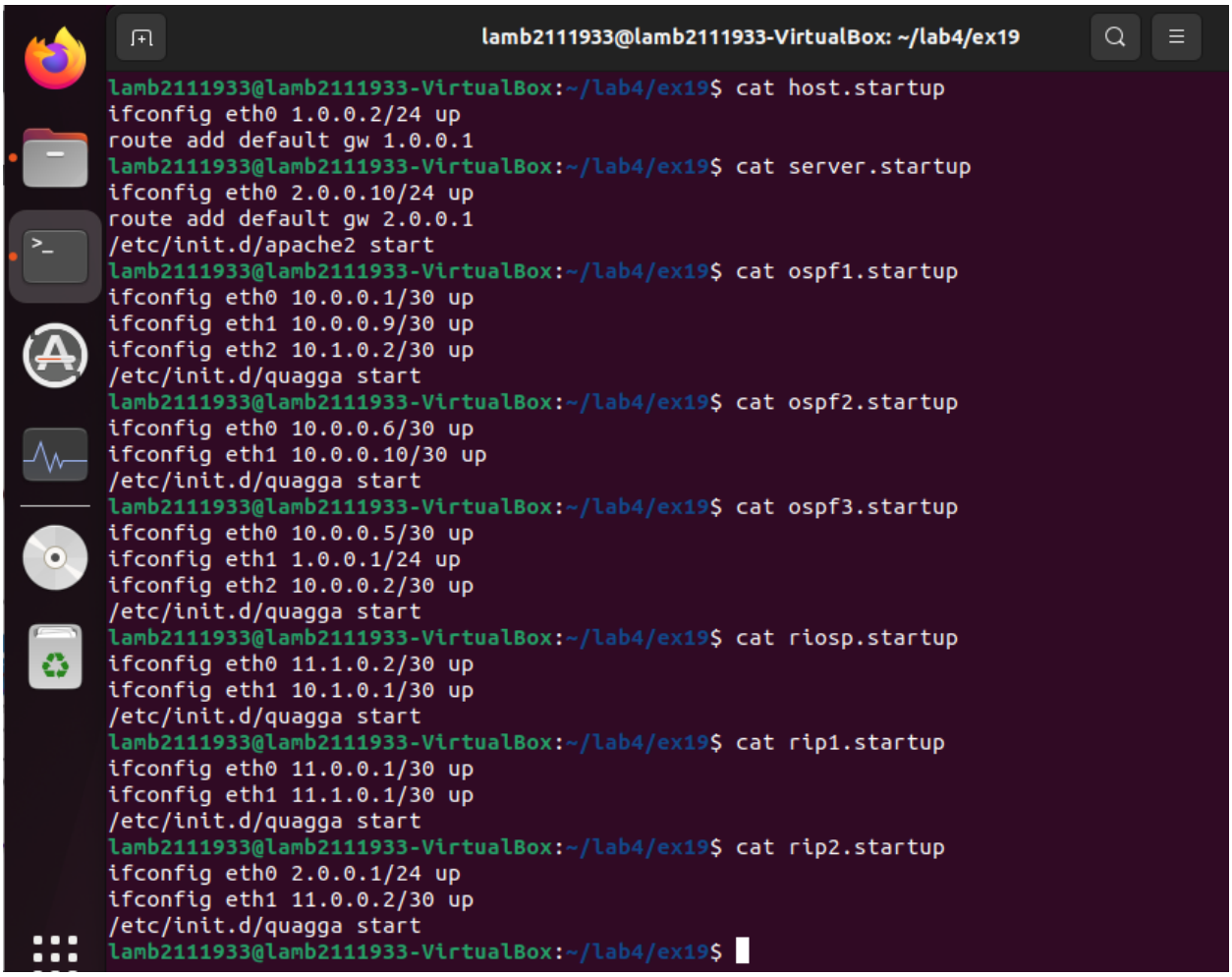

Create files and folders



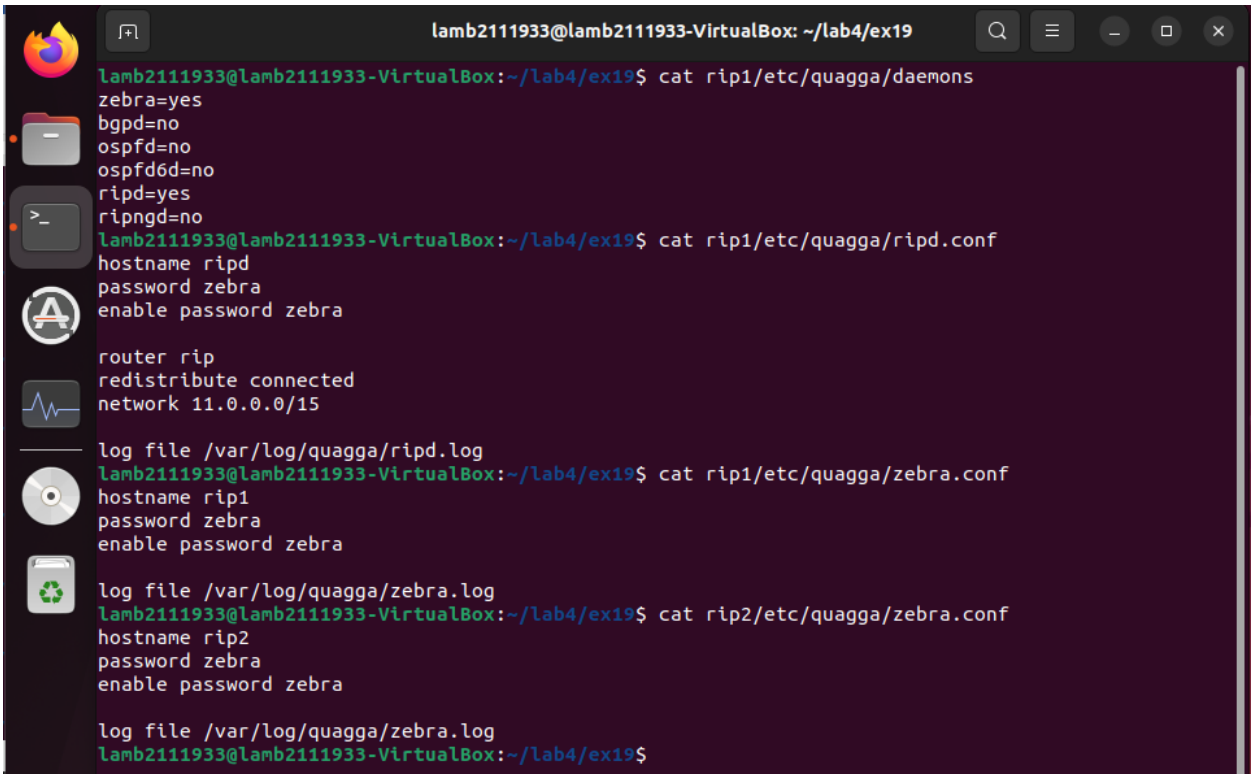


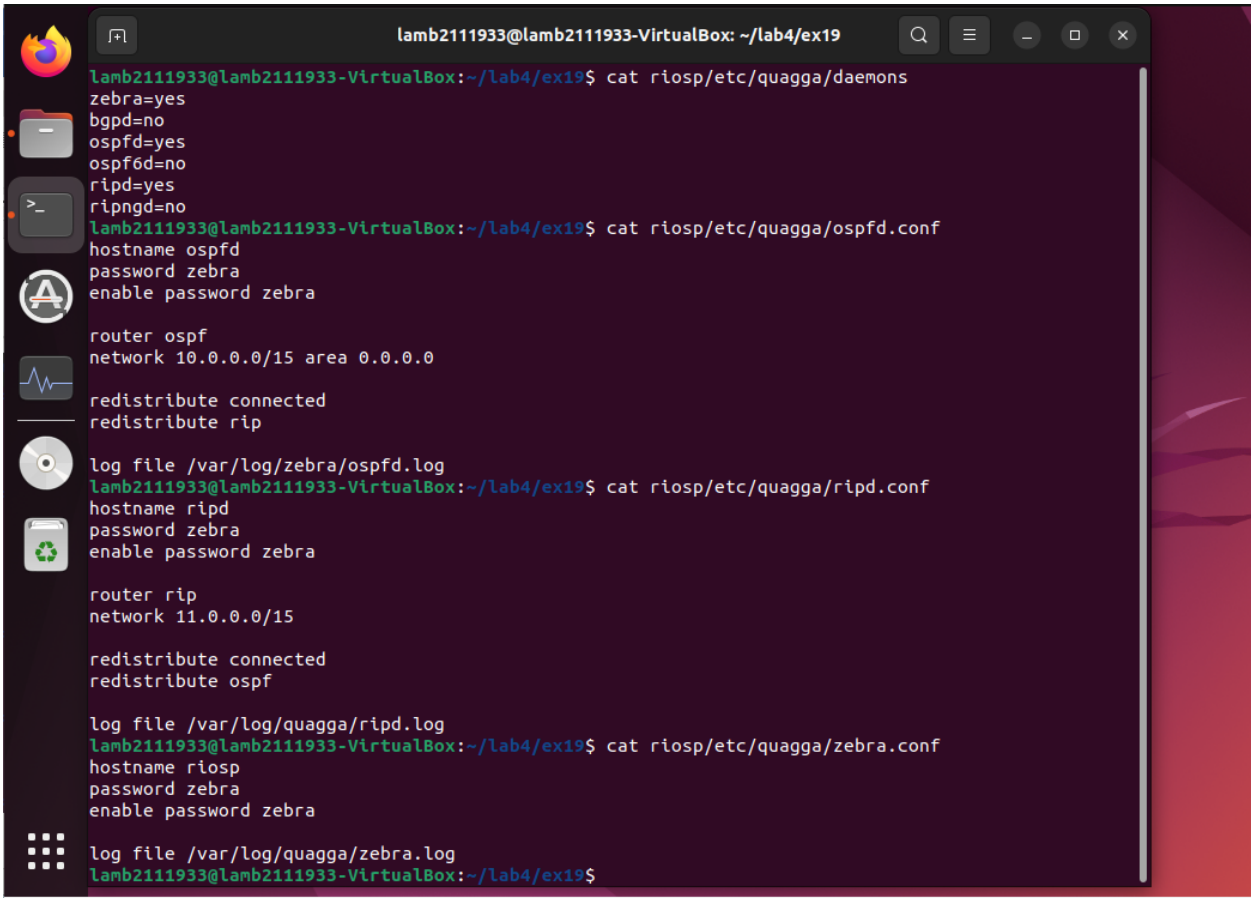

The contents of files



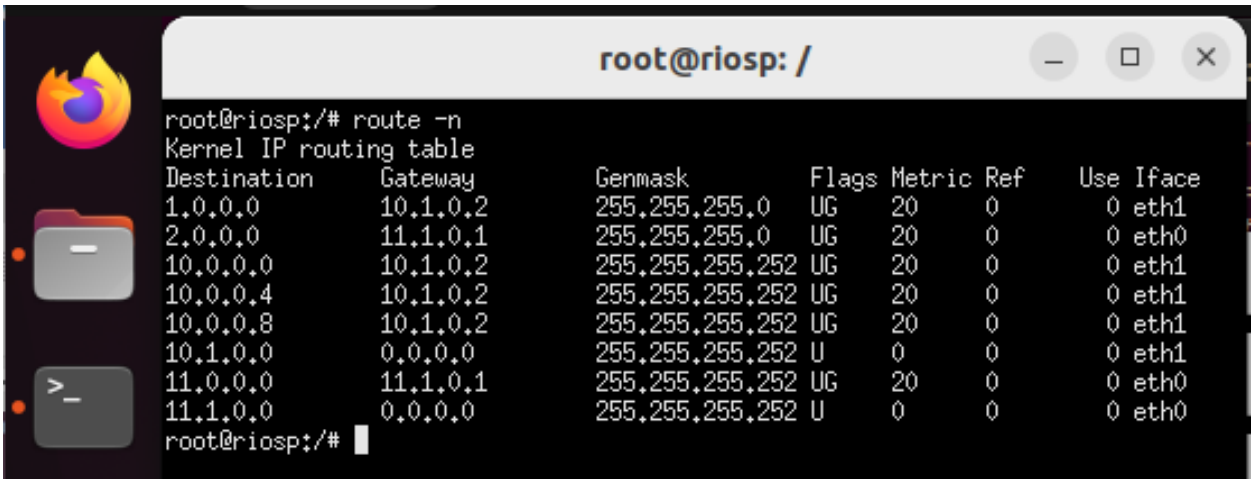

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat host.startup
ifconfig eth0 1.0.0.2/24 up
route add default gw 1.0.0.1
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat server.startup
ifconfig eth0 2.0.0.10/24 up
route add default gw 2.0.0.1
/etc/init.d/apache2 start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1.startup
ifconfig eth0 10.0.0.1/30 up
ifconfig eth1 10.0.0.9/30 up
ifconfig eth2 10.1.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf2.startup
ifconfig eth0 10.0.0.6/30 up
ifconfig eth1 10.0.0.10/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf3.startup
ifconfig eth0 10.0.0.5/30 up
ifconfig eth1 1.0.0.1/24 up
ifconfig eth2 10.0.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp.startup
ifconfig eth0 11.1.0.2/30 up
ifconfig eth1 10.1.0.1/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1.startup
ifconfig eth0 11.0.0.1/30 up
ifconfig eth1 11.1.0.1/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip2.startup
ifconfig eth0 2.0.0.1/24 up
ifconfig eth1 11.0.0.2/30 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$

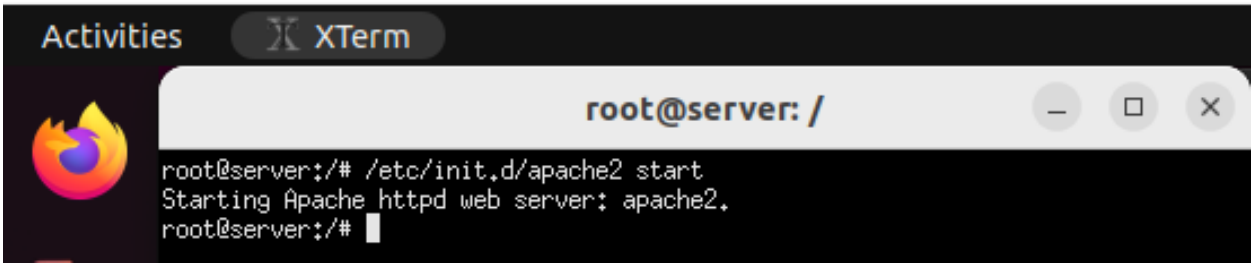

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=no
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat ospf1/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra
interface eth0
ospf cost 90
router ospf
network 10.0.0.0/15 area 0.0.0.0
redistribute connected
log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$

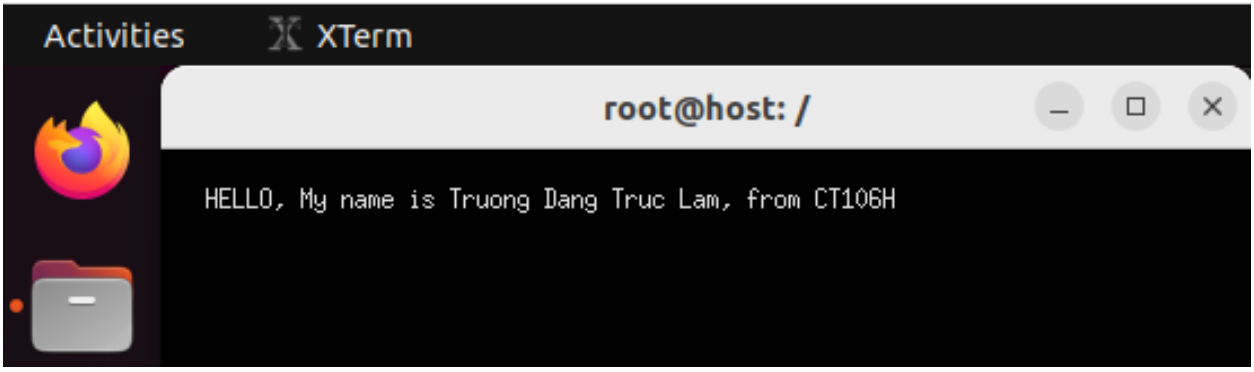

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=no
ospfd6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra
router rip
redistribute connected
network 11.0.0.0/15
log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip1/etc/quagga/zebra.conf
hostname rip1
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat rip2/etc/quagga/zebra.conf
hostname rip2
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$


lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex19
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/daemons
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
ripd=yes
ripngd=no
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/ospfd.conf
hostname ospfd
password zebra
enable password zebra
router ospf
network 10.0.0.0/15 area 0.0.0.0
redistribute connected
redistribute rip
log file /var/log/zebra/ospfd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/ripd.conf
hostname ripd
password zebra
enable password zebra
router rip
network 11.0.0.0/15
redistribute connected
redistribute ospf
log file /var/log/quagga/ripd.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$ cat riosp/etc/quagga/zebra.conf
hostname riosp
password zebra
enable password zebra
log file /var/log/quagga/zebra.log
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex19$


Let's check the result



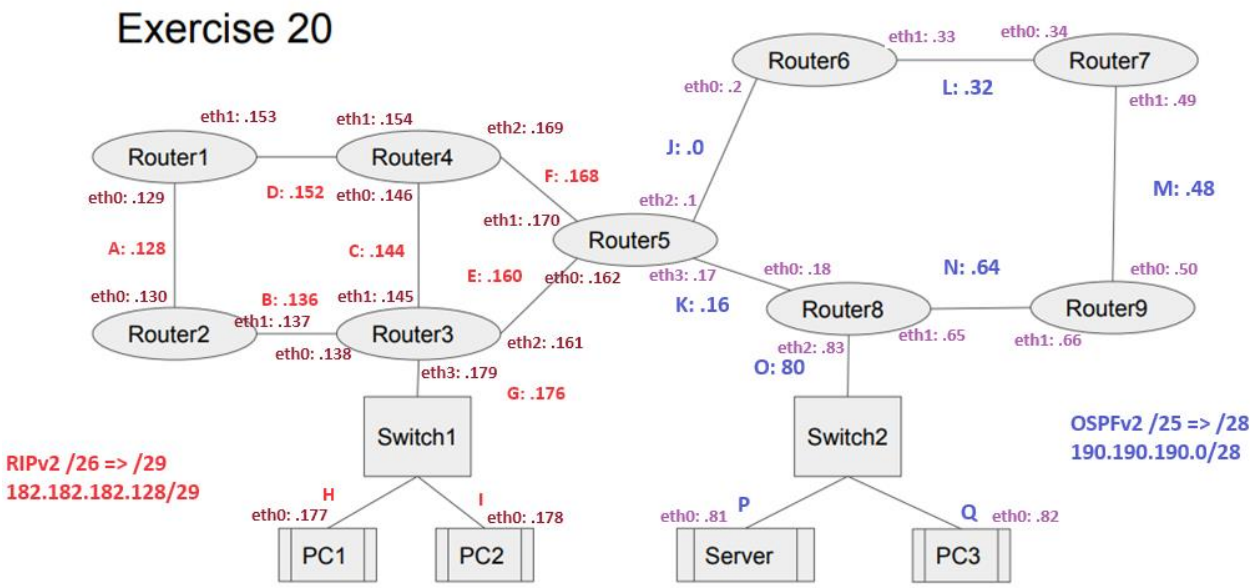



# Exercise 20

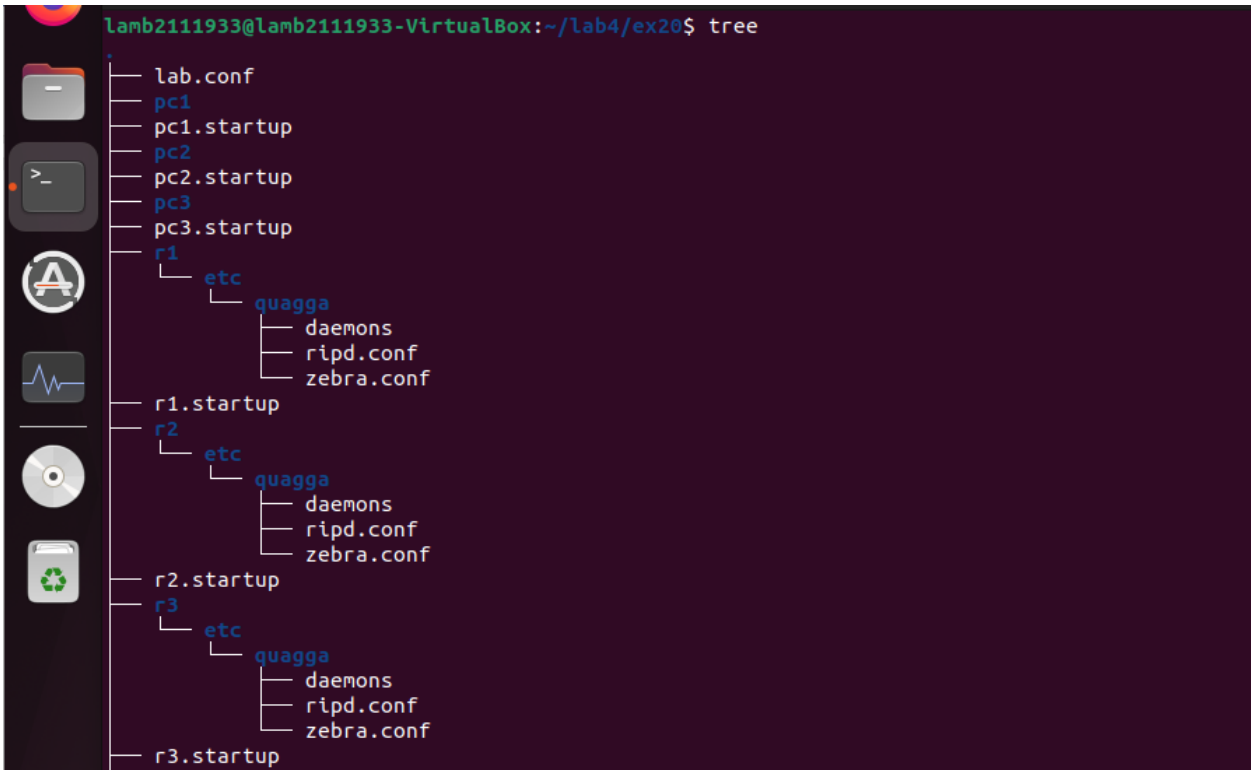
## Exercise 20

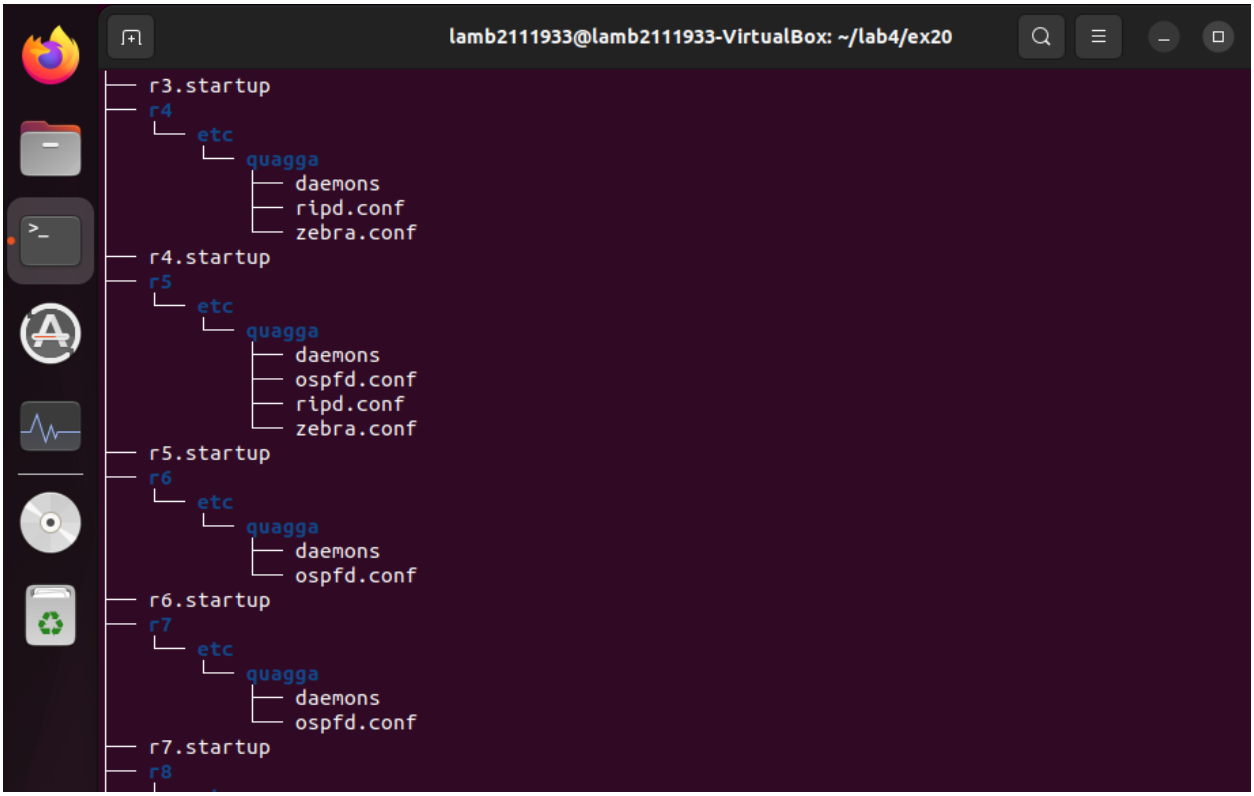
Construct the network on the next slide such that:

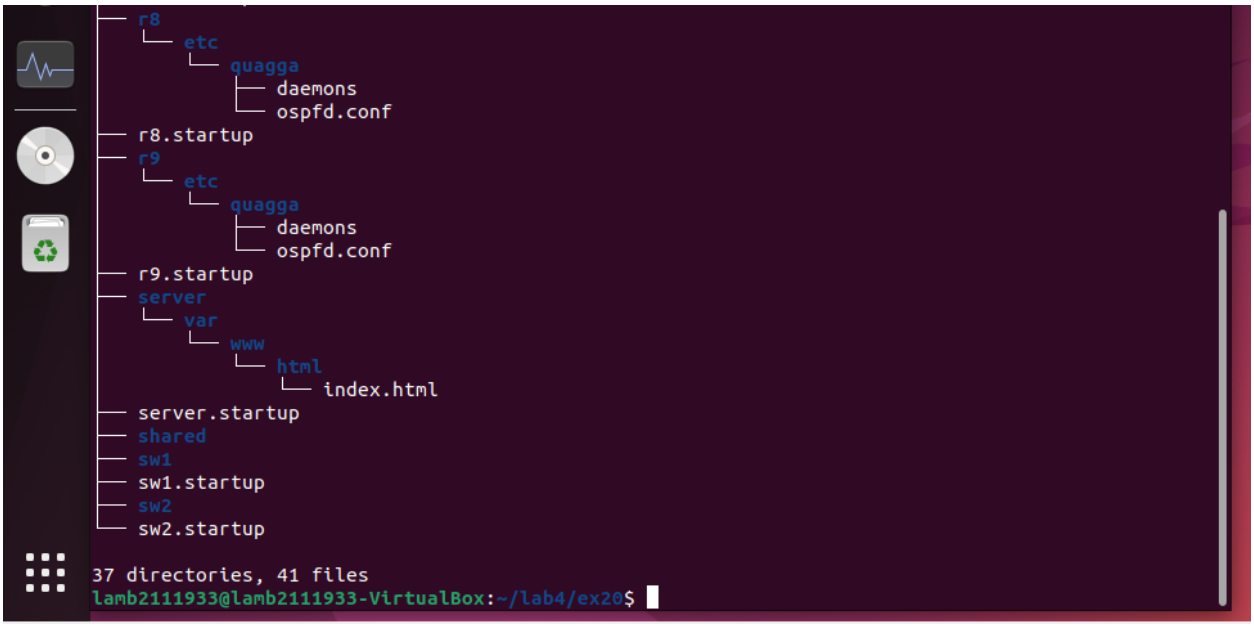
- Router 1, 2, 3, 4, 5 use the RIPv2 protocol.
  - The original network address is 182.182.182.128/26. What are the netmask and broadcast addresses of this original network?
  - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?
- Router 5, 6, 7, 8, 9 use the OSPFv2 protocol.
  - The original network address is 190.190.190.0/25. What are the netmask and broadcast addresses of this original network?
  - Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?
- The Server provides a web service which shows “CT106H is easy!”



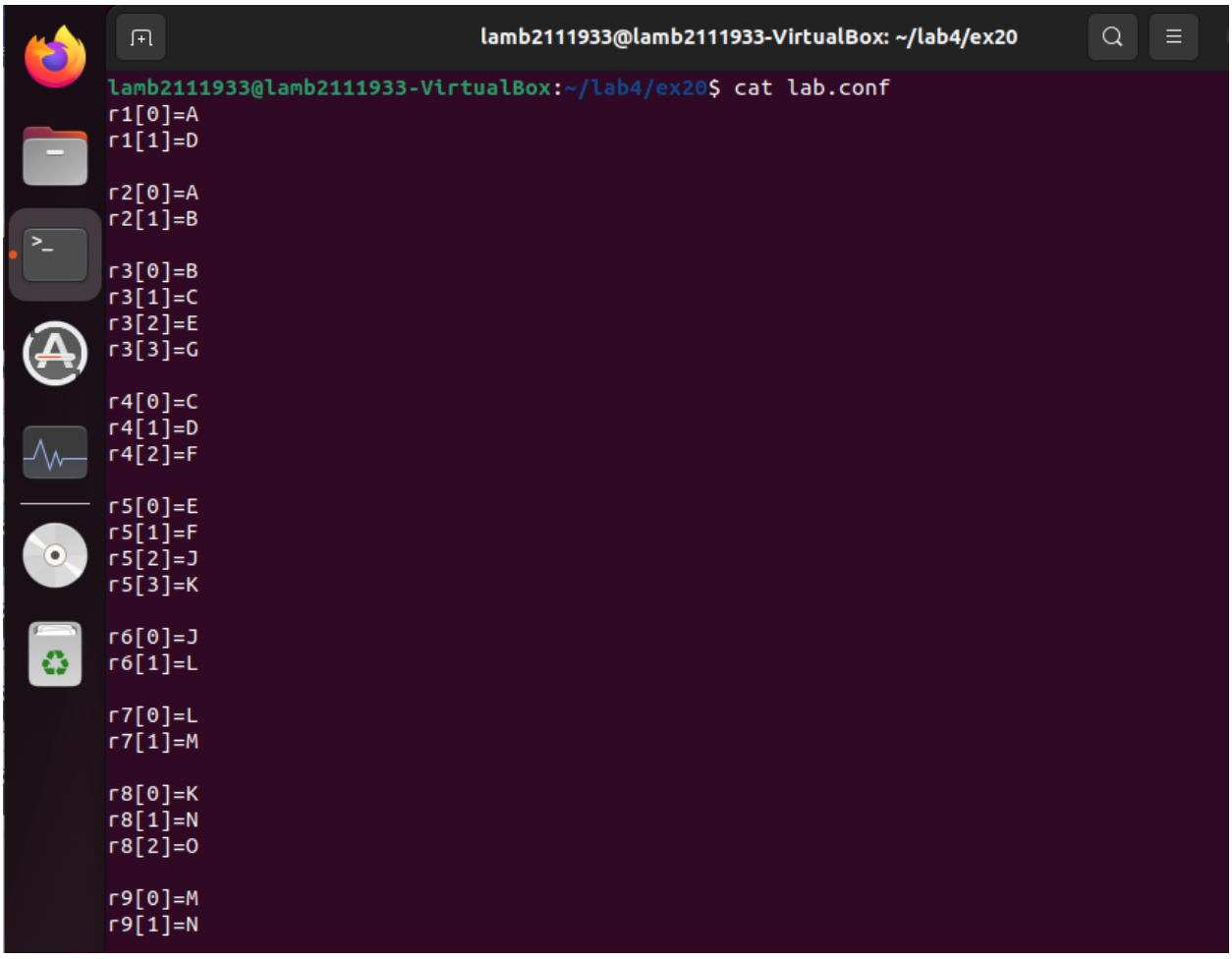
## Create files and folders



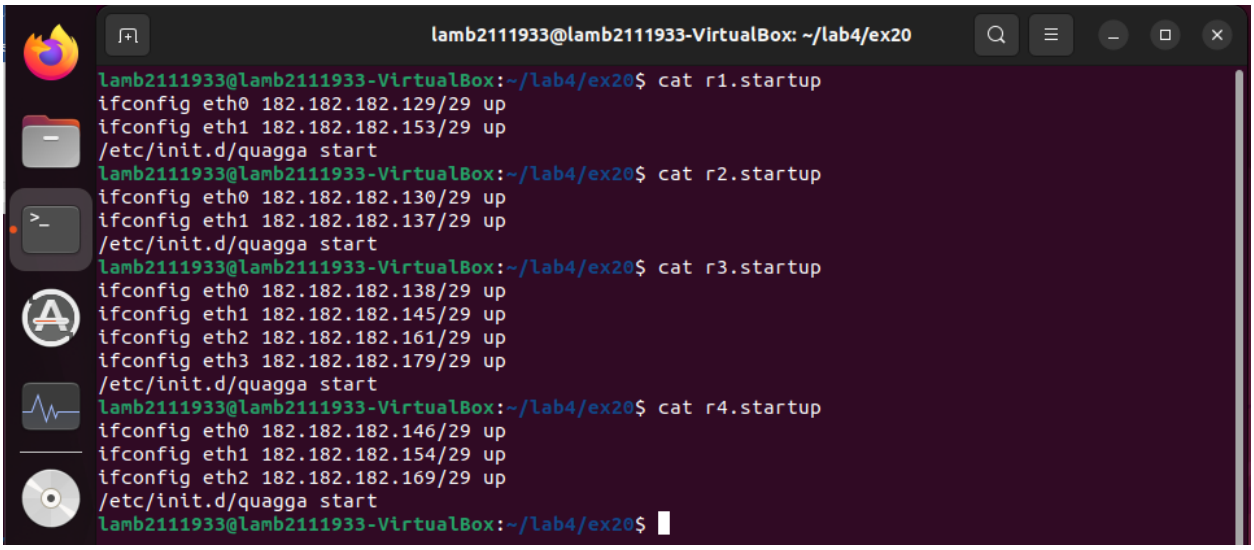



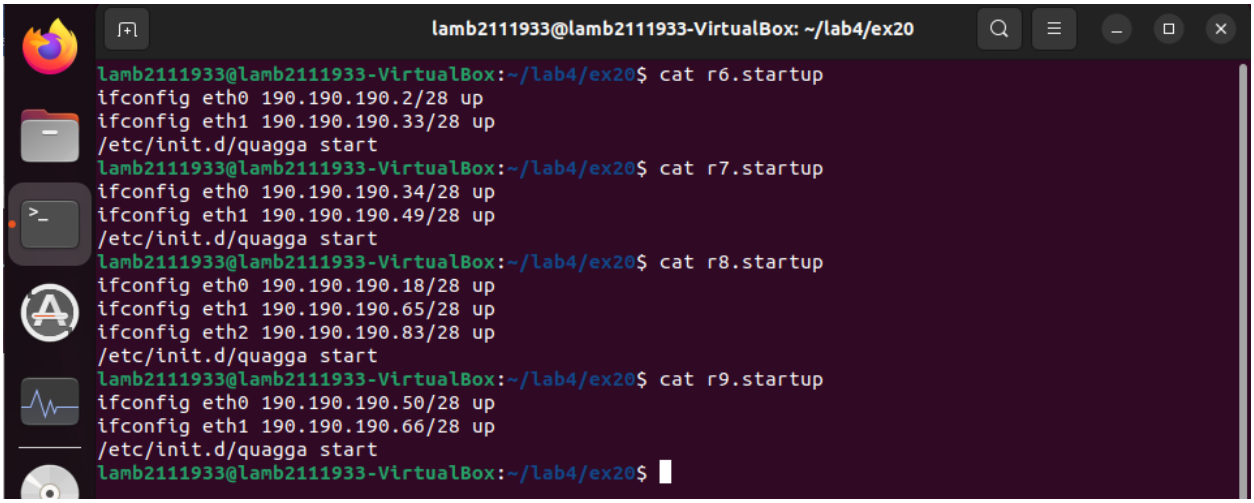


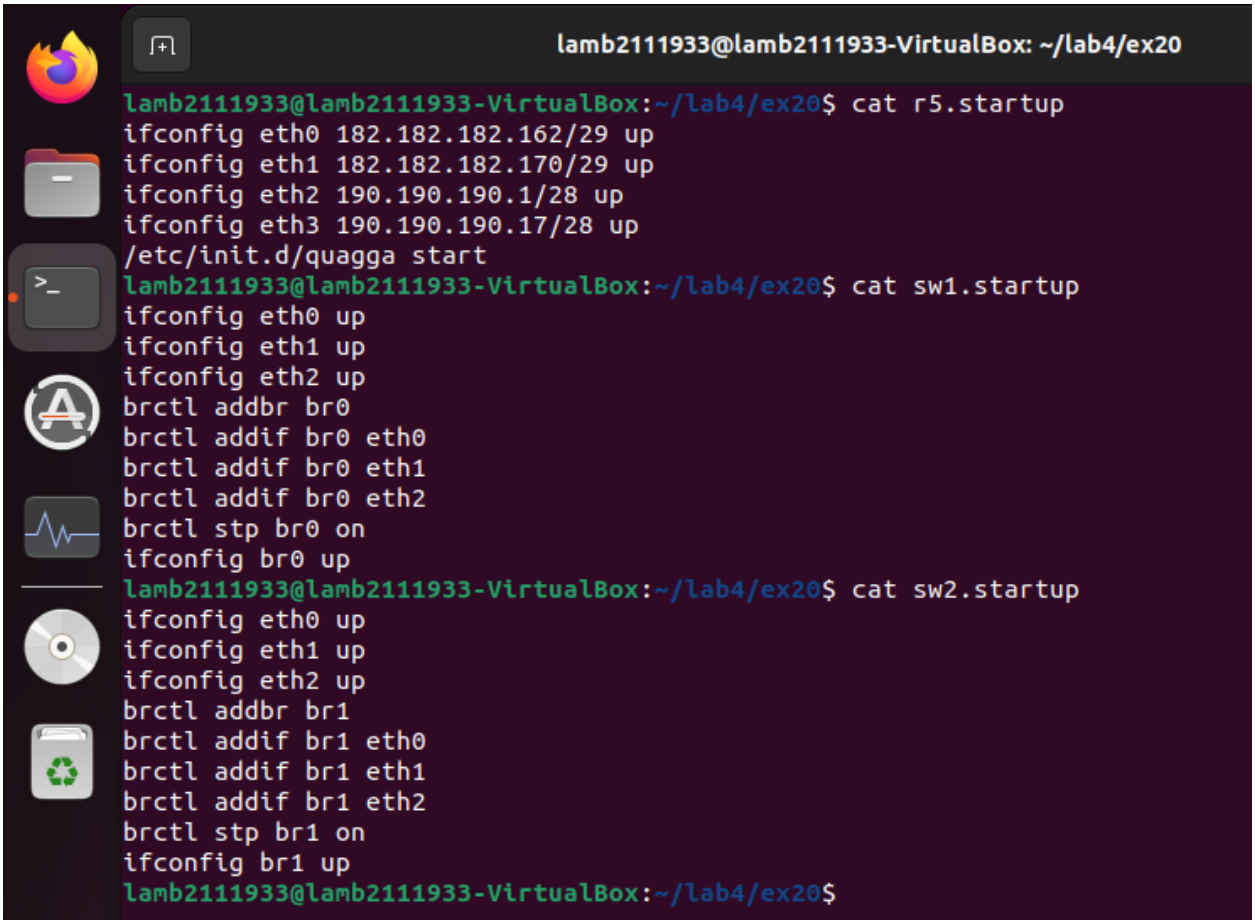

The contents of files

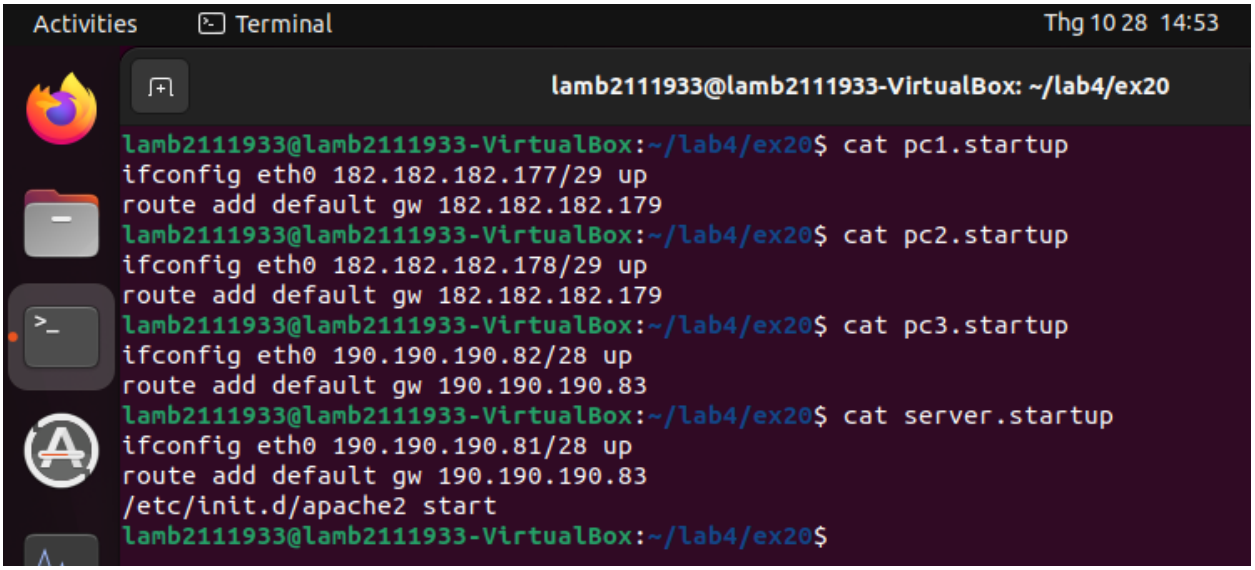



r9[0]=M
r9[1]=N
sw1[0]=G
sw1[1]=H
sw1[2]=I
sw2[0]=O
sw2[1]=P
sw2[2]=Q
pc1[0]=H
pc2[0]=I
pc3[0]=Q
server[0]=P
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$

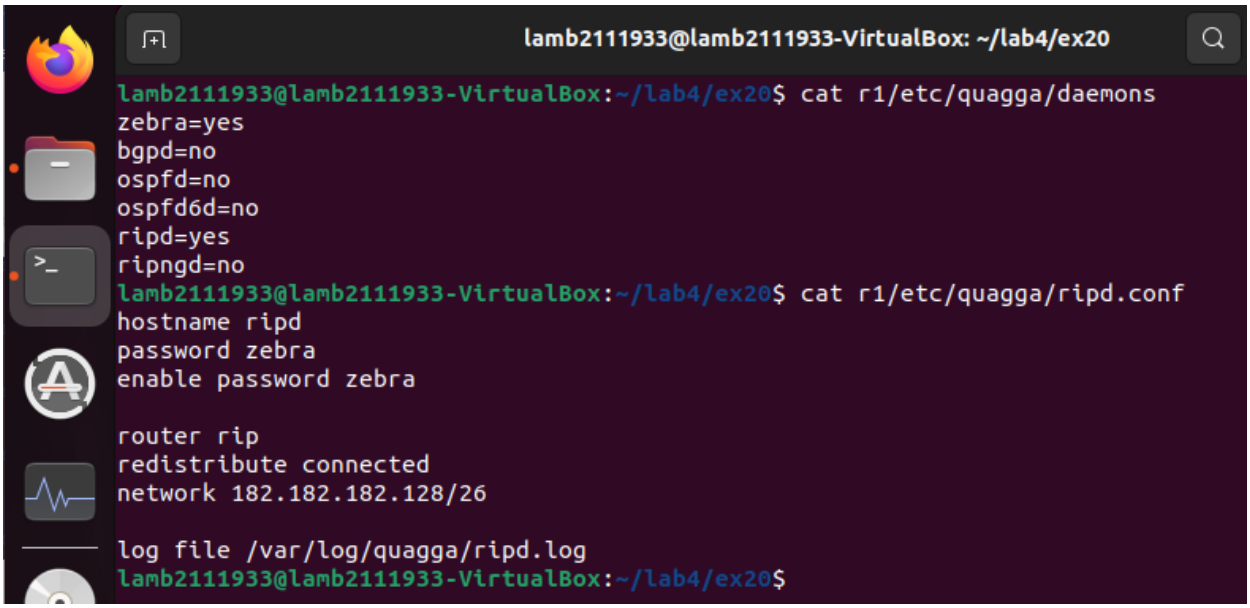

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r1.startup
ifconfig eth0 182.182.182.129/29 up
ifconfig eth1 182.182.182.153/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r2.startup
ifconfig eth0 182.182.182.130/29 up
ifconfig eth1 182.182.182.137/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r3.startup
ifconfig eth0 182.182.182.138/29 up
ifconfig eth1 182.182.182.145/29 up
ifconfig eth2 182.182.182.161/29 up
ifconfig eth3 182.182.182.179/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r4.startup
ifconfig eth0 182.182.182.146/29 up
ifconfig eth1 182.182.182.154/29 up
ifconfig eth2 182.182.182.169/29 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$

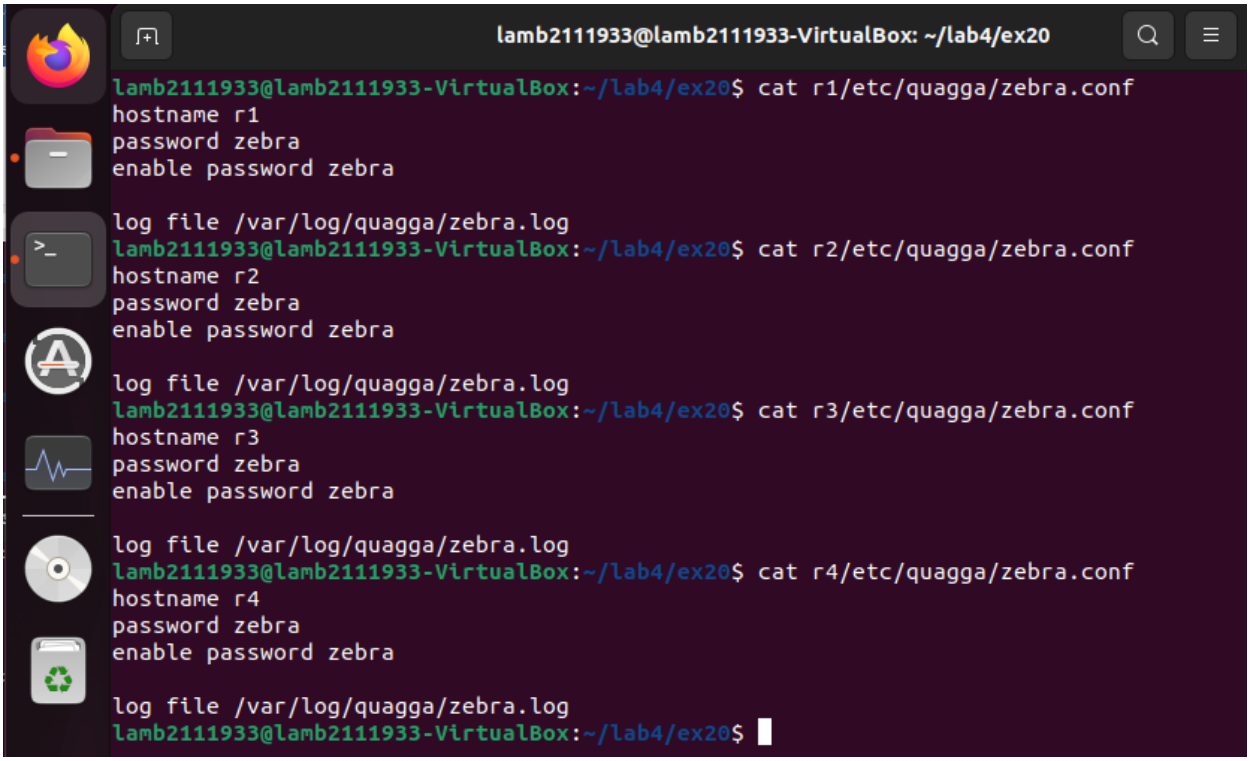

lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r6.startup
ifconfig eth0 190.190.190.2/28 up
ifconfig eth1 190.190.190.33/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r7.startup
ifconfig eth0 190.190.190.34/28 up
ifconfig eth1 190.190.190.49/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r8.startup
ifconfig eth0 190.190.190.18/28 up
ifconfig eth1 190.190.190.65/28 up
ifconfig eth2 190.190.190.83/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r9.startup
ifconfig eth0 190.190.190.50/28 up
ifconfig eth1 190.190.190.66/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$


lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat r5.startup
ifconfig eth0 182.182.182.162/29 up
ifconfig eth1 182.182.182.170/29 up
ifconfig eth2 190.190.190.1/28 up
ifconfig eth3 190.190.190.17/28 up
/etc/init.d/quagga start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat sw1.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up
brctl addbr br0
brctl addif br0 eth0
brctl addif br0 eth1
brctl addif br0 eth2
brctl stp br0 on
ifconfig br0 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat sw2.startup
ifconfig eth0 up
ifconfig eth1 up
ifconfig eth2 up
brctl addbr br1
brctl addif br1 eth0
brctl addif br1 eth1
brctl addif br1 eth2
brctl stp br1 on
ifconfig br1 up
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$


Activities
Terminal
Thg 10 28 14:53
lamb2111933@lamb2111933-VirtualBox: ~/lab4/ex20
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc1.startup
ifconfig eth0 182.182.182.177/29 up
route add default gw 182.182.182.179
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc2.startup
ifconfig eth0 182.182.182.178/29 up
route add default gw 182.182.182.179
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat pc3.startup
ifconfig eth0 190.190.190.82/28 up
route add default gw 190.190.190.83
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$ cat server.startup
ifconfig eth0 190.190.190.81/28 up
route add default gw 190.190.190.83
/etc/init.d/apache2 start
lamb2111933@lamb2111933-VirtualBox:~/lab4/ex20$

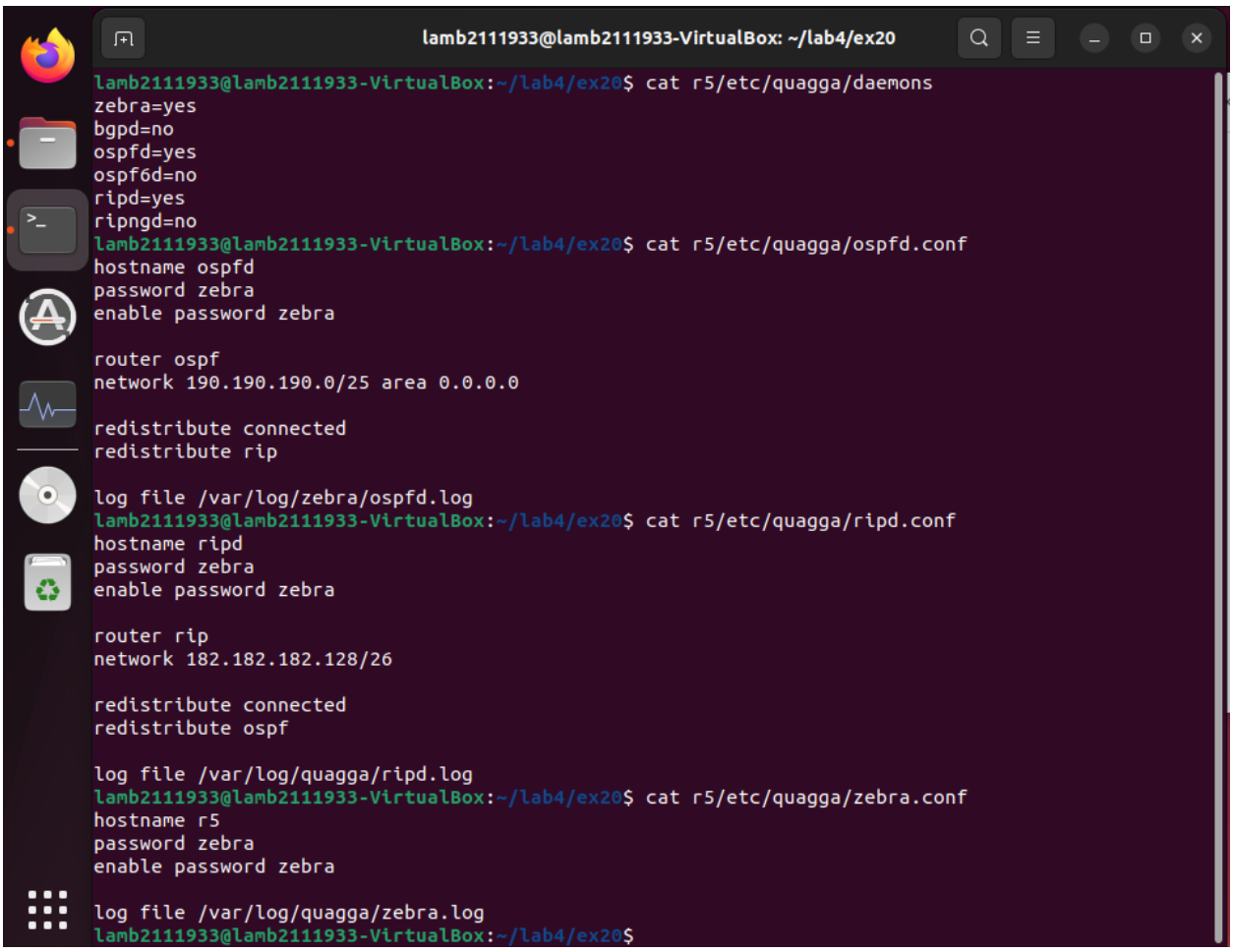
Folder **etc** of **r1**,**r2**,**r3**,**r4** – **RIPv2**
They are just the same, only a little different in **zebra.conf (hostname)**



Folder **etc** of **r6**,**r7**,**r8**,**r9** – **OSPFv2**
They are just the same too


Folder **etc** of **r5** – **OSPFv2 + RIPv2**



- Router 1, 2, 3, 4, 5 use the RIPv2 protocol.

  ○ The original network address is 182.182.182.128/26. What are the netmask and broadcast addresses of this original network?

  - Netmask: 255.255.255.192 (/26)
  - Broadcast address: 182.182.182.191

  ○ Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?

| Subnet | Network Address | Broadcast Address | Netmask |
|---|---|---|---|
| A | 182.182.182.128/29 | 182.182.182.135/29 | 255.255.255.248 |
| B | 182.182.182.136/29 | 182.182.182.143/29 | 255.255.255.248 |
| C | 182.182.182.144/29 | 182.182.182.151/29 | 255.255.255.248 |
| D | 182.182.182.152/29 | 182.182.182.159/29 | 255.255.255.248 |
| E | 182.182.182.160/29 | 182.182.182.167/29 | 255.255.255.248 |
| F | 182.182.182.168/29 | 182.182.182.175/29 | 255.255.255.248 |
| G | 182.182.182.176/29 | 182.182.182.183/29 | 255.255.255.248 |

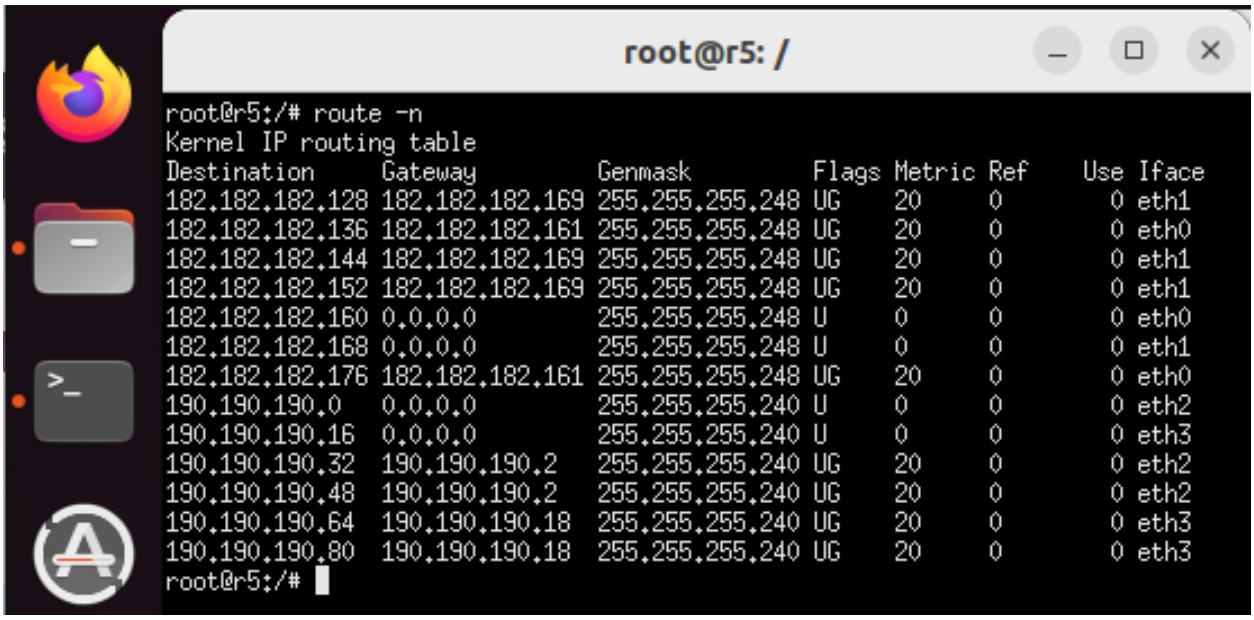
- Router 5, 6, 7, 8, 9 use the OSPFv2 protocol.

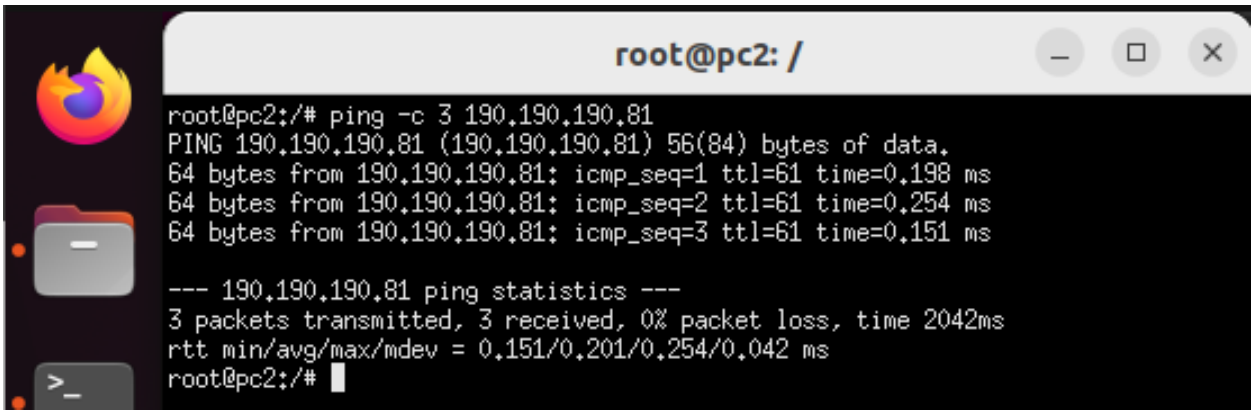
  ○ The original network address is 190.190.190.0/25. What are the netmask and broadcast addresses of this original network?

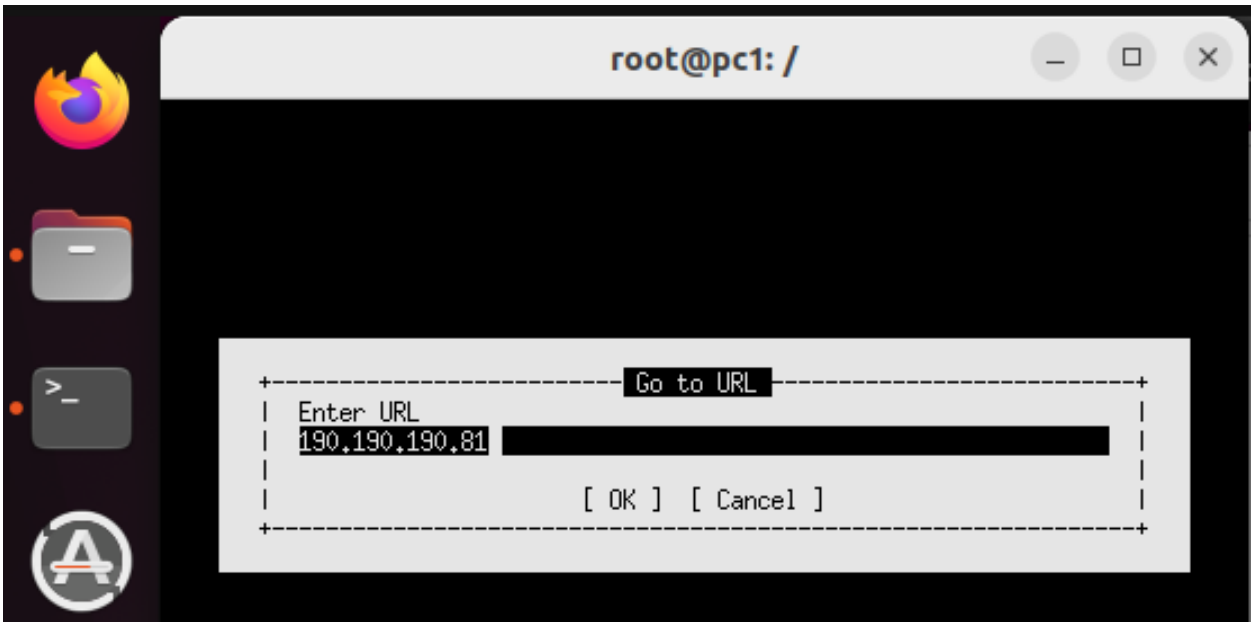
  - Netmask: 255.255.255.128 (/25)
  - Broadcast address: 190.190.190.127/25

  ○ Assign the network address to each LAN on the network by subnetting the original network. What are the netmask and broadcast addresses of each subnetwork?

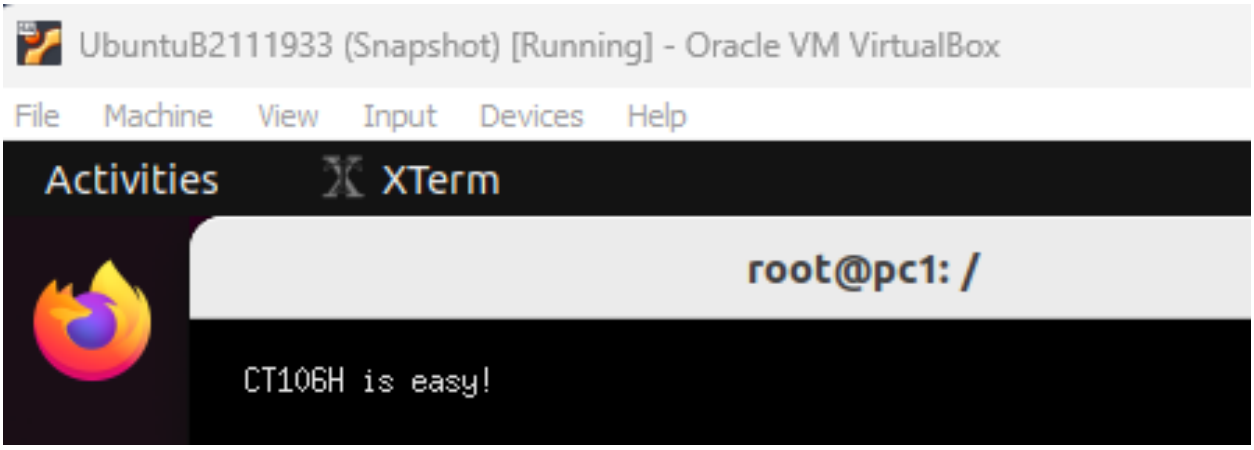
| Subnet | Network Address | Broadcast Address | Netmask |
|---|---|---|---|
| J | 190.190.190.0/28 | 190.190.190.15/28 | 255.255.255.240 |
| K | 190.190.190.16/28 | 190.190.190.31/28 | 255.255.255.240 |
| L | 190.190.190.32/28 | 190.190.190.47/28 | 255.255.255.240 |
| M | 190.190.190.48/28 | 190.190.190.63/28 | 255.255.255.240 |
| N | 190.190.190.64/28 | 190.190.190.79/28 | 255.255.255.240 |
| O | 190.190.190.80/28 | 190.190.190.95/28 | 255.255.255.240 |


root@r5: /
root@r5:/# route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
182.182.182.128 182.182.182.169 255.255.255.248 UG 20 0 0 eth1
182.182.182.136 182.182.182.161 255.255.255.248 UG 20 0 0 eth0
182.182.182.144 182.182.182.169 255.255.255.248 UG 20 0 0 eth1
182.182.182.152 182.182.182.169 255.255.255.248 UG 20 0 0 eth1
182.182.182.160 0.0.0.0 255.255.255.248 U 0 0 0 eth0
182.182.182.168 0.0.0.0 255.255.255.248 U 0 0 0 eth1
182.182.182.176 182.182.182.161 255.255.255.248 UG 20 0 0 eth0
190.190.190.0 0.0.0.0 255.255.255.240 U 0 0 0 eth2
190.190.190.16 0.0.0.0 255.255.255.240 U 0 0 0 eth3
190.190.190.32 190.190.190.2 255.255.255.240 UG 20 0 0 eth2
190.190.190.48 190.190.190.2 255.255.255.240 UG 20 0 0 eth2
190.190.190.64 190.190.190.18 255.255.255.240 UG 20 0 0 eth3
190.190.190.80 190.190.190.18 255.255.255.240 UG 20 0 0 eth3
root@r5:/#


root@pc2: /
root@pc2:/# ping -c 3 190.190.190.81
PING 190.190.190.81 (190.190.190.81) 56(84) bytes of data.
64 bytes from 190.190.190.81: icmp_seq=1 ttl=61 time=0.198 ms
64 bytes from 190.190.190.81: icmp_seq=2 ttl=61 time=0.254 ms
64 bytes from 190.190.190.81: icmp_seq=3 ttl=61 time=0.151 ms
--- 190.190.190.81 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2042ms
rtt min/avg/max/mdev = 0.151/0.201/0.254/0.042 ms
root@pc2:/#


root@pc1: /
Go to URL
Enter URL
190.190.190.81
[ OK ] [ Cancel ]

Enjoy the result




(not really easy at all)